INPUT®

56

Federal Information
Systems and Services Program
(FISSP)

Federal Large-Scale Systems Market

CONTENTS

NOVEMBER 1988

FEDERAL LARGE-SCALE SYSTEMS MARKET

INPUT®

8298C, Old Courthouse Rd., Vienna, Virginia 22180 (703) 847-6870

Published by
INPUT
8298C, Old Courthouse Rd.
Vienna, Virginia 22180
U.S.A.

Federal Information Systems and Services Program (FISSP)

Federal Large-Scale Systems Market

GLIS • 416/405 • 1988

Abstract

This report examines the federal market for large-scale systems. It identifies the federal agencies' requirements and the application areas supported by existing and planned systems.

INPUT believes that the federal market demand for large-scale systems will grow from $2.8 billion in FY 1988 to $3.7 billion in 1993, at an average annual growth rate of 5%. Along with the market forecast, this report also describes the major market issues and trends impacting the industry. It also discusses the vendors' perspectives of the market.

This report contains 175 pages, including 63 exhibits.

Table of Contents

Table of Contents (Continued)

Table of Contents (Continued)

Table of Contents (Continued)

Exhibits

Exhibits (Continued)

Exhibits (Continued)

Introduction

The federal government's large-scale systems have evolved to support a wide range of mission-support functions and the automation of much of the information processing essential to agency operations. These systems have grown in capabilities as technological advancements were incorporated by the government's ADP modernization efforts. Future systems will become even more versatile as standards promoting interoperability are implemented and steps are taken to elevate the large federal information processing systems to current commercial technological levels.

This report on the large-scale computer systems market of the federal government was prepared as part of INPUT's Federal Information Systems and Services Program (FISSP). The report's findings are based on research and analyses of several sources, including:

- INPUT's Procurement Analysis Reports (PAR)
- OMB/GSA/NBS Five-Year Information Technology Plans for 1988-1993
- Interviews with leading federal large-scale systems vendors
- Interviews with federal agency officials with active and planned large-scale computer acquisitions
- Federal agency GFY 1988 information technology budgets
- Computer Intelligence's analysis of federal equipment inventory

A

Purpose and Scope

This report responds in part to client requests for a detailed treatment of the federal hardware market. As this report was being developed, INPUT was also developing a report on the federal market for mid-size systems. In 1989, INPUT will produce a report on the federal microcomputer market.

This report also serves to supplement INPUT's previous reports on systems integration and facilities management. It is intended to give INPUT's clients a clear description of the current status and future trends of the federal market. It also identifies the key vendors in this market, a subject of continuing interest to INPUT's clients.

This report covers federal large-scale systems in the 1988 to 1993 timeframe. It includes both the traditional mainframe systems as well as supercomputers.

At this writing, GFY 88 was coming to a close, and some programs were still feeling the effects of the DoD freeze initiated in April 1988. Two government standards were also scheduled to be mandated on September 1, 1988: Government Open Systems Integration Profile (GOSIP); and POSIX (Portable Operating System Interface for UNIX). Both of these standards have significantly influenced governmentwide hardware and software procurement decisions.

B

Methodology

In developing this report, INPUT used a variety of sources and methods. First, INPUT researched agency long-range plans and budget submissions for GFY 1988-1993 for major systems replacements and new system initiations (new starts). Based on this research, INPUT pinpointed those agencies and programs that dealt with large systems for further investigation.

INPUT also reviewed the Procurement Analysis Reports (PARs) to develop further insights on agency activities. Many PARs cover programs which, for one reason or another, do not appear in the agency budget submissions. This situation yields additional possibilities for further research.

Questionnaires were developed for both agency officials and vendor respondents (see Appendixes F & G).

- The agency questionnaire was designed to acquire information about current experience and plans for future use of large-scale computer systems.
- The vendor questionnaire was designed to acquire information on industry status and future federal market plans.

Often the same, or similar, questions were asked of both groups of respondents for comparative analysis purposes. Federal agency officials selected for interview included:

- Agency executives at the policy level
- Program managers

Industry representatives selected for interview included:

- Marketing executives
- Technical executives
- Corporate executives

Vendor interviewees were selected because they were either identified as contractors of record for existing large-scale computer systems, or listed as large-scale systems vendors in INPUT's Company Analysis and Monitoring Service data base for 1988. The agencies selected for interview were identified in one or more of the above plans as proposing to contract for large-scale systems solutions over the next five years.

In developing the market forecast, INPUT relied on several sources. First, INPUT's proprietary budget model was consulted. This model consists of all combined agency budget submissions, with additions for those off-budget items already identified, and subtractions for those items which INPUT believes will be delayed or cancelled. INPUT also relied on the federal inventory data provided by *Computer Intelligence*. Finally, INPUT took the survey responses into account in adjusting the forecast numbers.

C
Report Organization

This report consists of five additional chapters. These are:

- Chapter II—contains an Executive Overview describing the major points and findings in the report.
- Chapter III—provides the market forecast and describes the major market issues and trends impacting the industry.
- Chapter IV—summarizes the federal agencies' requirements for large systems and the application areas supported by existing and planned systems.
- Chapter V—presents the vendors' perspectives on the federal large-scale systems market.
- Chapter VI—provides a sample of business opportunities for programs and initiatives in the federal market involving large-scale systems.

Several appendixes are also provided:

- Interview Profiles
- Definitions
- Glossary of Federal Acronyms
- Policies, Regulations, and Standards
- Related INPUT Reports
- Questionnaires

Executive Overview

A

Federal Market Pressures

The federal market for large-scale systems is expected to continue to grow slowly over the next five years, as described in Section B. Some of the pressures impacting this growth are listed in Exhibit II-1. Government programs require steady improvement in both the quality and quantity of information technology support.

In its drive to improve productivity—to do more with less—the federal government is increasingly reliant on information technology. At the same time, functional and pricing trends, especially in terms of large systems and associated software, have opened up new opportunities in government for using the technology.

Because of a huge base of installed applications software, agencies continue a heavy commitment to maintain and enhance existing systems, as well as to develop new systems. Also, there is administrative support for federal agencies to eliminate their systems that are obsolete. Further, pressure to reduce the federal budget deficit increases the importance of efficiency and innovation in large-scale system design.

EXHIBIT II-1

FEDERAL MARKET PRESSURES

- Improve Information Technology Support
- Improve Productivity
- Maintain and Enhance Systems
- Overcome Computer Obsolescence
- Adjust to Budgetary Constraints

B

Market Forecast

The federal market for large-scale systems will grow from $2.8 billion in FY 1988 to $3.7 billion in FY 1993, an average annual growth rate of 5%. Exhibit II-2 displays a breakdown of the federal hardware market into large-scale, mid-size, and microcomputers.

Although INPUT has not previously forecasted the federal large-scale computer market, it has regularly provided forecasts for the overall federal hardware market. The $4.3 billion total for FY 1988 represents a slight reduction from the $4.5 billion that INPUT provided at the federal conference in June 1988.

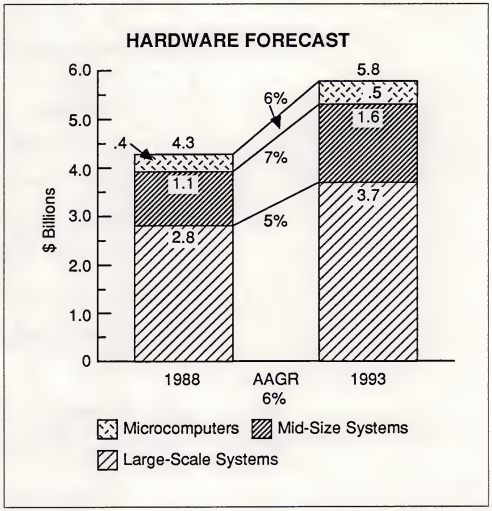
This change arose from the following factors:

- Several major hardware procurements, expected to be awarded in FY 1988, have been delayed as a result of an unprecedented level of protest activity
- Higher than expected salary expenses in many federal agencies are causing a reduction in many program areas, including information systems.

The lower growth of large-scale systems, when compared with the other categories, stems in part from the following factors:

- Many functions formerly performed on shared mainframes are now being moved to dedicated mid-size systems

EXHIBIT II-2



- Supercomputers, although growing sharply in the federal market, make up a very small percentage of the large-systems category.
- Mainframes remain too expensive for many mid-size agency activities.

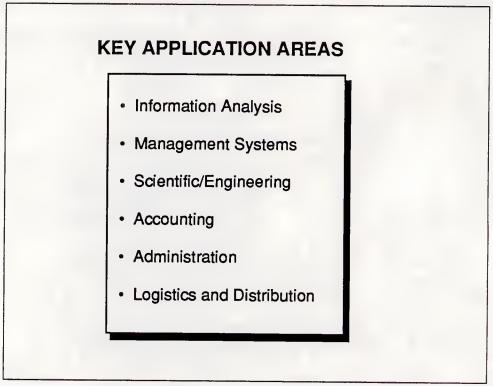
C

Application Areas

Large-scale systems support a wide variety of application areas. While Department of Defense and civilian agencies differ somewhat in their emphasis, the application areas of information analysis and management systems dominate agency responses, as shown in Exhibit II-3. Logistics support is also becoming more important, as agencies move to automate their supply and delivery processes.

Scientific and engineering applications make up the major application areas for supercomputers. These high-powered machines are performing complex modeling and computational functions for government research laboratories and computer facilities. Future applications for supercom-

EXHIBIT II-3



puters involve graphics and other areas of information analysis. These are the application areas that agency respondents view as developing for supercomputers as their usage increases throughout the federal government.

D

Competitive Forces

The large-scale systems market is faced with competition from the supermini- and mini-supercomputers that have similar computing capabilities to various classes of mainframes. A blurring of distinctions among performance levels for general-purpose computers is occurring. This blurring also applies to the specification of some applications traditionally run on mainframes. Many computers in either the supermini or minisuper range emphasize being able to handle all types of applications, including scientific or engineering applications. This emphasis has sparked the interest of the defense department agencies to respond to their need for computing simulations.

Competition in the market is also rising from the Japanese, who are working to gain a foothold in the supercomputer market. Their presence is forcing the U.S. manufacturers to become increasingly competitive in terms of the price and performance features of their equipment. The Japanese government is supportive of their companies' development of high-performance computers and promotes technological advances useful for increasing the Japanese market share.

In addition, the federal processing services segment of the large-system market has been competitively pressured in recent years. The government user is turning to end-user computing micro- and minicomputers to accomplish some of the information processing once accomplished only on mainframes. Vendors and agencies agree that micros will eventually replace remote computer services (RCS) for those requirements that do not require networking, extensive data base interaction, or massive computation.

Competitive forces are listed in Exhibit II-4.

EXHIBIT II-4

COMPETITIVE FORCES IN LARGE-SCALE MARKET

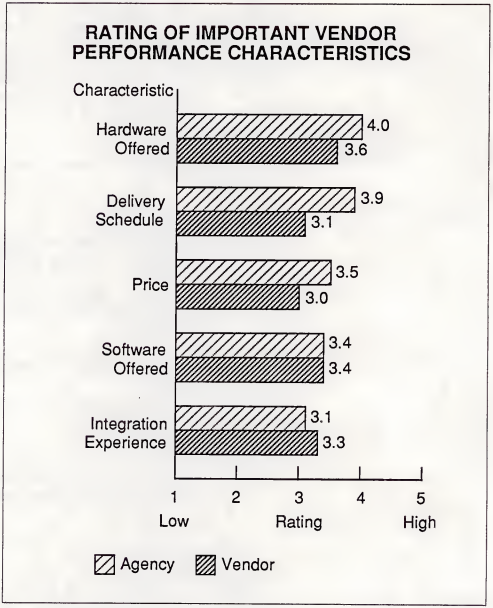
- Increased Performance Levels of Computers
- Competition from Superminis
- Increased Presence of Japanese Manufacturers
- Decline in Federal Processing Services Market Segment

E

Agency Satisfaction

The overall level of satisfaction with contracted large-scale system vendors' performance appears relatively high. Exhibit II-5 compares agency and vendor satisfaction levels (both DoD and civilian) with vendors' perception of those satisfaction levels. The exhibit summarizes those areas, with the strongest showing being for hardware offerings. For the most part, agency responses were higher than those of their vendor counterparts. The scale ranges from 1 to 5, with 5 being the highest rating. These represent considerably higher ratings than INPUT encountered in a similar survey on professional services, suggesting that hardware vendors are delivering better on their promises.

EXHIBIT II-5



F

Contractor Selection Criteria

Source evaluation and selection complicate the marketplace for large-scale systems. Agencies evaluate hardware proposals in a wide variety of ways, leading to some confusion on the part of the vendors. Exhibit II-6 compares vendor ranking and agency ranking of contractor selection criteria. The differences shown in this exhibit, when brought down to the specific project, may lead to unnecessary weaknesses in the proposal.

It should be remembered, however, that most agency responses came from program managers and technical personnel, rather than contracting officers. Most contracting officers show great reluctance to award to any but the lowest bidder, especially if the difference in prices is significant.

EXHIBIT II-6

RELATIVE IMPORTANCE OF CONTRACTOR SELECTION CRITERIA

SELECTION CRITERIA	VENDOR RANKING	AGENCY RANKING
Life Cycle Cost	1	2
Proposed Technical Solution	2	1
Risk Containment	3	3
Initial Cost	4	5
Contract Type	5	4

G

Recommendations

In this competitive federal market for large-scale systems, vendors need to adopt various strategies to succeed. These recommendations are set forth in Exhibit II-7.

Federal agencies continue to express their concern over operating in extremely diverse hardware and software environments. Therefore, many vendors should intensify their efforts to adhere to industry standards, thus promoting compatibility and interoperability. This will facilitate the vertical and horizontal integration of information, both within and between organizations.

Because agencies have become dependent on their computer systems, companies in this market need to develop and maintain positive reputations. This is accomplished by providing technically and economically feasible systems. This strategy will serve to enhance the industry's image with agency officials. Large-scale vendors are especially damaged when hardware or software fails to perform as advertised. Such failures happen quite often, seriously hurting the vendor's credibility.

Finally, as with most other federal market segments, vendors need to invest more effort in understanding the agency's mission and its information resources requirements. This knowledge will enable the vendors to develop appropriate system solutions, rather than mis-sizing and misconfiguring their bids.

EXHIBIT II-7

RECOMMENDATIONS

- Stress Standards and Interoperability
- Maintain Positive Reputation
- Improve Reliability of Products and Product Support
- Increase Familiarity with System Requirements

Market Analysis and Forecast

As has already been pointed out, technology advances have largely blurred the distinction between large and mid-size systems. Available applications also tend to mix the categories, since many federal applications will function both efficiently and effectively on both large- and mid-size systems. However, for the purposes of analysis and forecast, INPUT has divided the categories largely along the same lines described by Data Sources, Inc. Section A provides more detailed information on the breakout.

In developing its forecast, INPUT identified and analyzed those trends affecting the federal hardware market in general and the large-scale category in particular. Some trends, such as the growing federal popularity of supercomputers, directly affect the large-systems category. Others, such as present and future budget constraints, affect virtually all information system categories. Therefore, in developing this section, INPUT took into account all available significant trends.

A
Market Structure

1. Mainframes

The present large-scale mainframe system is one in which general purpose computing or traditional mainframes have now been expanded to incorporate many of these technological developments:

- Very large-scale integrated circuitry
- Integrated network communications
- Very high speed memory
- Distributive processing

Significant technological developments and end-user expectations, which serve to determine the range of mainframe products, are still taking place. However, these factors also serve to blur the distinctions into mid-size system hardware and even approach the realm of supercomputers on the

high end. Exhibit III-1 lists some of the mainframes that INPUT has classified as large-scale. It does not include such common products as the Digital VAX systems, which are classified as mid-size systems and presented in another INPUT report. This report also excludes embedded systems and CAD/CAM systems.

EXHIBIT III-1

SELECTED MAINFRAME MANUFACTURERS AND MODELS— LARGE-SCALE SYSTEM HARDWARE

MANUFACTURER	MAINFRAME MODEL
Control Data	Cyber Series
Honeywell Bull	DPS 88
IBM	308X, 309X
National Advanced Systems	AS Series
UNISYS	1100/8X, 9X
NCR	Various
Amdahl	5880, 5890

2. Supercomputers

Supercomputers have high-powered processors with numerical processing that is significantly greater than the fastest general-purpose computers. As supercomputers developed, they incorporated such advanced technology as specialized vector processors, parallel processor design, greater packaging densities, and innovative cooling techniques. These technologies may not be suitable for some mainframes, or may not be applied to general-purpose mainframes until the future.

The success of supercomputers has stemmed from their capability to completely perform very complex calculations in a short timeframe and also perform specific algorithms and "number crunching" tasks. INPUT

has classified supercomputers as those large-scale computers with capacities in the 100-500 million floating point operations per second (MFLOPS) range. Newer supercomputers—with burst modes over 500 MFLOPS, main storage size up to 10 million words, and on-line storage in the one-to-three gigabyte class—are labeled Class IV to Class VII in agency long-range plans and are also included in the study of the federal large-scale computer market.

Cray Research was the first company to deliver a supercomputer to the federal government at the Los Alamos National Laboratory in 1976. Since then, Control Data Corporation and its spinoff company ETA have installed many of their model supercomputers at government agencies. In addition, three Japanese companies (Hitachi, NEC, and Fujitsu) have also entered the supercomputer market via systems integrators to the federal government. Furthermore, IBM has developmental efforts underway to produce an advanced supercomputer.

Exhibit III-2 lists many of the model supercomputers and their basic characteristics that are currently installed or planned for the federal government and private sector industry. The government installed most of its early-model supercomputers in the Department of Defense, Department of Energy and NASA at government laboratories and research environments. The Class VI supercomputers in use today and the Class VII models being acquired are performing mathematical calculations and scientific modeling at previously unimaginable speeds. For comparison, a calculation taking 35 hours on a PC requires seven minutes on a mainframe and can be completed in two seconds on a supercomputer.

Supercomputers continue to grow in popularity among federal users, particularly for highly scientific applications. In particular, INPUT's Procurement Analysis Reports show a steady stream of supercomputer requirements for the Department of Energy. The DoD will also continue to require supercomputers for both scientific and classified applications.

EXHIBIT III-2

SUPERCOMPUTER MODELS AND CHARACTERISTICS

Vendor Model	Number of Processors	Architecture	Peak Performance	Main Memory Size	Technology	
					Logic	Main Memory
CDC Cyber-205	1 CPU	Multiple Vector Units	400 Mflops	128 Mbytes	ECL (700ps)	MOS (45ns)
IBM 3090-400	4 CPUs	Vector and Multiprocessing	430 Mflops	128 Mbytes	ECL N/A	N/A N/A
Fujitsu VP-200	1 CPU	Multiple Vector Units	500 Mflops	256 Mbytes	ECL (350ps)	MOS (55ns)
Hitachi S-810/20	1 CPU	Multiple Vector Units	630 Mflops	256 Mbytes	ECL (350 ps)	MOS (40ns)
CRI Cray-X/MP	4 CPUs	Vector and Multiprocessing	850 Mflops	128 Mbytes	ECL (500ps)	ECL (38ns)
NEC SX-2	1 CPU	Multiple Vector Units	1300 Mflops	256 Mbytes	CMOS (250ps)	MOS (40ns)
CRI Cray-2	4 CPUs	Vector and Multiprocessing	1800 Mflops	2000 Mbytes	ECL (500ps)	MOS (240ns)
CRI Cray-Y/MP	8 CPUs	Vector and Multiprocessing	3 Gflops	1 Gbytes	ECL (250ps)	ECL (36ns)
ETA ETA-10	8 CPUs	Vector and Multiprocessing	5 Gflops	2 Gbytes	CMOS (250ps)	MOS (240ns)
CRI Cray-3	16 CPUs	Vector and Multiprocessing	10 Gflops	8 Gbytes	GaAs (125ps)	MOS (30ns)

Source: "Supercomputers in Government", Mr. Reed Phillips, Director, OIRM, Department of Commerce, Presentation INPUT FISSP Conference, December 2, 1987.

Exhibit III-3 illustrates the distribution of large computer systems currently installed throughout the civilian and defense agencies. The Department of Defense agencies account for a larger number of large-scale systems, however the civilian agencies' purchase value for their systems exceeded the purchase value of the DoD systems. The installed systems

at the agencies do not include any systems made up of mid-size equipment.

EXHIBIT III-3

LARGE SYSTEMS INSTALLED AT FEDERAL AGENCIES

Large Systems	DoD Agencies	Civilian Agencies
Total Number of Systems	951	787
Purchase Value of Systems ($ Thousands)	777,106	1,255,428

Source: Computer Intelligence, September 1988.

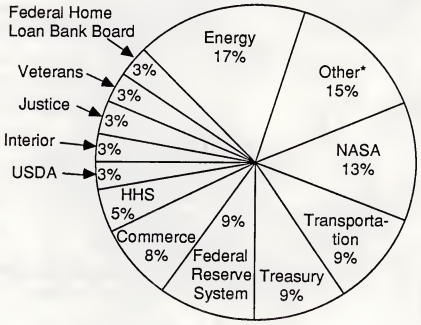
Exhibit III-3 suggests a sharp difference in average per system value: $817,000 for the DoD and nearly $1.6 million for civilian agencies. A closer inspection of the available data reveals even wider differences within the civilian agencies. For example, the average NASA system is worth nearly $1.6 million and the average Department of Energy system about $1.5 million. However, the average system at the VA costs only $905,000. Average cost relates to the complexity of the system and its age. And, because there is no reason to conclude that DoD systems are less complex, it may be concluded that they are older. A recent GSA report on the federal inventory supports this conclusion. In GSA's "very large" and "large" categories, the Defense computers are mostly grouped at the longer end of the lists.

The percentages of systems both by number and purchase value for major civilian and defense agencies are shown in Exhibits III-4 and III-5. The largest share of civilian systems are installed at the Department of Energy (17%), followed by NASA (13%). This statistic reflects the concentration of supercomputers in these agencies, as already discussed. These two agencies' systems also have a similarly high share of purchase values for their systems. Most of the civilian agencies have comparative percents of number of systems and their value, with the exception of HHS

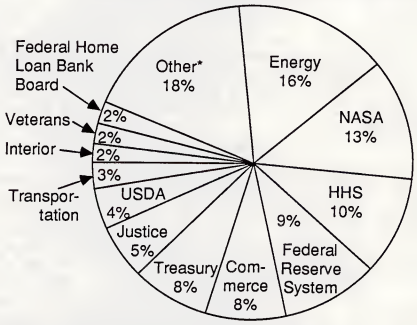
EXHIBIT III-4

LARGE SYSTEMS INSTALLED AT CIVILIAN AGENCIES

Percentage by Number of Systems



Percentage by Purchase Value of Systems



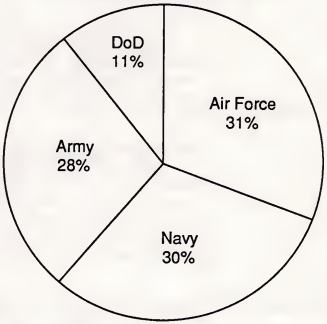
*Other includes remaining civilian agencies surveyed.

Source: Computer Intelligence, September 1988.

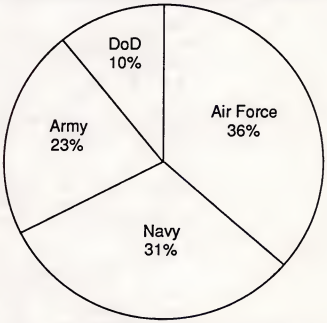
EXHIBIT III-5

LARGE SYSTEMS INSTALLED AT DEFENSE AGENCIES

Percentage by Number of Systems



Percentage by Purchase Value of Systems



Source: Computer Intelligence, September 1988.

and Transportation. The systems at HHS comprise 5% of the total number of systems, but their purchase value is estimated at 10%. Conversely, the Department of Transportation's systems are 9% of the total number, but only account for 3% of the value for installed civilian agencies.

This is inconsistent with GSA's inventory report, which shows Transportation's computers to be considerably newer than those at HHS. Either one of the data sources is incomplete or HHS' computers, on average, are considerably larger than those at the Department of Transportation. This last alternative is reflected in the GSA data, which show very few large systems at Transportation.

The distribution of large systems among the major defense agencies is shown in Exhibit III-5, with Air Force having slightly more systems. The Air Force has an even larger percentage of the purchase value for the installed systems in the defense agencies. This is consistent with GSA data, which shows Air Force computers to be somewhat newer than those at other defense agencies. Again, system totals do not include those systems made up of mid-size computer equipment.

B

Market Forecast

The federal market for large-scale systems will grow from $2.8 billion in FY 1988 to $3.7 billion in FY 1993, at an average annual growth rate of 5%. Exhibit III-6 divides the federal hardware market into large-scale systems, mid-size systems, and microcomputers.

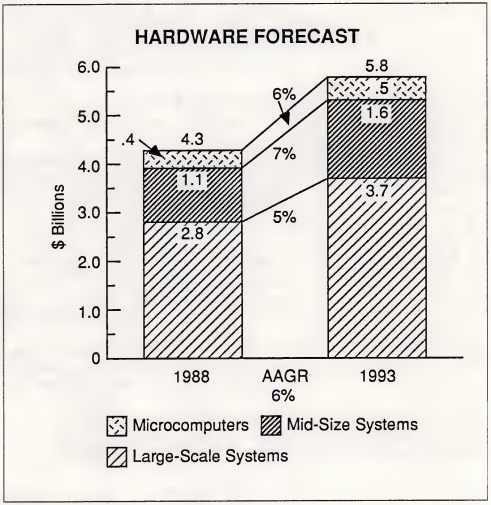
As part of its forecast model, INPUT has regularly provided estimates of the growth in hardware sales to the federal government. However, this is the first time INPUT has presented a breakout of that forecast by segments. INPUT differed somewhat from other market research firms by dividing the federal hardware market into large-scale, mid-size, and microcomputers. What some other firms label "small systems" has been included in our mid-size category.

The $4.3 billion total for FY 88, which also includes telecommunications equipment and systems software, represents a slight reduction from the $4.5 billion figure that INPUT provided at its federal conference in June 1988. This change arose from the following factors:

- Several major hardware procurements, expected to be awarded in FY 1988, have been delayed by protests. In the past year, the General Services Board of Contract Appeals (GSBCA) has experienced an unprecedented level of protest activity. This activity has slowed numerous procurements.

- Higher than expected salary expenses in many federal agencies are causing a reduction in many program areas, including information

EXHIBIT III-6



systems. Recently, Congress approved a 4% pay raise for FY 1989, without appropriating any additional money. Thus the agencies must absorb the pay raise by cutting other areas, including information systems. Some of the systems subject to cuts include the SEC's EDGAR project, administrative systems at the Department of Transportation, Agriculture's Field Office Communications Automated System, and various systems at Justice's Immigration and Naturalization Service.

Despite the near-term cut, INPUT has not changed its overall hardware market estimate for 1993. The forces driving this market remain largely in place. Therefore, with a lower base, INPUT has raised its growth rate forecast from 5% to 6%.

The lower growth rate of large-scale systems, when compared with the other categories, stems in part from the following factors:

- GSA is currently discouraging agency "grand designs" because of their associated cost, duration, and visibility. This attitude will result in some agencies acquiring more-modest systems and meeting their "grand design" requirements in a more modular fashion.

- Supercomputers, while growing sharply, will continue to represent a fairly small percentage of the large-scale market.

- Many functions formerly performed only on mainframes are now going to mid-size systems. The concept of departmental computing is growing in popularity, as organizations within an agency may gain more control over their own resources.

- Remote computing services, although not declining in an absolute sense, will continue to decline as a percentage of the federal budget. Agencies will replace these with more local-area networks for microcomputers and mid-size systems. The ready availability of these smaller systems will decrease demand for large-scale systems.

- Finally, mainframes have become too expensive for many mid-size agency activities. With continuing budget constraints, many agencies will opt for more cost-effective solutions, even if it involves giving up some functionality.

C

Federal Market Issues

1. Federal Policies and Regulations

The federal large-scale systems market is subject to a wide range of federal policies and regulations. Earlier, federal ADP and telecommunications systems were procured and managed for more than two decades by the FPRs, FPMRs, and ASPRs. ADPE and services procurements were modified by the 1966 Brooks Act and subsequent amendments.

The Office of Federal Procurement Policy (OFPP) was created in 1976 to develop a single procurement code and uniform procedures for the federal government. For example, the OFPP developed OMB Circular A-109, for major systems acquisitions, including ADP systems. It is still in effect, but only for larger ($100 - $500 million) contracts or acquisition of controversial systems. In recent years, it has be waived or side stepped, even for large procurements.

The Paperwork Reduction Act of 1980 includes a number of provisions concerning information resource management and system acquisitions. The act:

- Created the post of Information Resources Management in each department and major agency

- Placed all but sensitive and mission-essential ADP under a new "mini-Brooks Bill"
- Provided a separate approval procedure for national security and defense mission ADP
- Authorized annual preparation and publication of a Federal Agency Five-Year Plan for major ADP/Telecommunications Acquisition by OMB and GSA

Under the authority of the Federal Administration Act and the Paperwork Reduction Act, GSA prepared and made effective in April 1984 a new set of regulations for information resources. The Federal Information Resource Management Regulations (FIRMR) superseded the FPR and FPMR in information technology areas. It combined in one regulation the acquisition, management, and use of all ADP and telecommunications not covered by separate statutes for reasons of sensitivity. It was initially based on the related sections of the FPMR and the FAR, as well as related provisions of DARC and CAAC-originated FAR amendments. GSA intended that the FIRMR would streamline the information resources acquisition process. GSA is now rewriting the FIRMR to reflect significant legal and regulatory changes. At this writing, a new draft of the FIRMR has been issued by GSA for agency and industry comment.

Other regulations and policy initiatives that are changing the acquisition procedures include:

- The Competition in Contracting Act (CICA) of 1984, which provides expanded legal powers for ADP protest action via the GSA Board of Contract Appeals (GSBCA) and GAO, increases the opportunity to employ negotiated contracts, and establishes seven more restrictive categories of exceptions that permit sole-source awards.
- The Paperwork Reduction Reauthorization Act of 1986 expanded the power of the GSBCA, but also retained the Warner Amendment, which provides DoD with mission-critical ADP procurement exemptions to Brooks Act coverage, except for application of general-purpose ADPE in noncritical functions, such as testing, recalibration, and programmer workbenches.

Several issues have arisen that are now being studied. These include software rights, data rights, and second sourcing of some systems. INPUT expects that these issues will continue to create problems on some procurements.

As is well known in the vendor community, the CICA has not achieved what was expected. It was expected to improve competitive opportunities, while the GSBCA provided more equitable resolution of protests.

The results have been anything but equitable. Today, virtually all major procurements are protested. A new word has entered the federal procurement vocabulary—fedmail. Some agencies and winning vendors are providing payments to protesters in order to secure withdrawal of the protest. As a result, a new growth industry is developing for lawyers specializing in federal procurement.

Other GSA procedures, aimed at facilitating the procurement process, have led to successful protests. Under the ongoing "Go for 12" program and the more recent "Trail Boss" concept, GSA is attempting to accelerate key procurements by authorizing acquisitions by prequalified experts without extensive management reviews. Thresholds have been raised, Agency Procurement Requests (APR) have been simplified, and delegation turnaround has been speeded up.

These protests have led to problems. Most successful protests result from defects in one or more of the following factors:

- Procurement process inconsistencies
- Improper documentation
- Defective pricing
- Inconsistent information dissemination

This limited procurement review has eliminated much of the expert examination of procurement actions. Many vendors now believe that more review is needed. Some have even indicated that, in certain circumstances, losing can be more profitable than winning.

Another policy issue that is evolving in the federal arena is that of down-sizing the "Grand Design" approach to procurements. In a draft GSA report released in July 1988, GSA suggested adoption of a modular approach or division of procurements for systems into smaller pieces. The report's recommendation comes from interviews on 10 "Grand Design" systems and outlines these systems shortfalls and problems. Exhibit III-7 is a table from the report that summarizes these issues. The report is still generating industry and government comments on whether or not the modular approach will work efficiently and what effect, if any, down-sizing would have on system integration contractors.

One other issue will bear watching in 1989. At this writing, Congressman Jack Brooks of Texas is expected to take over the Chairmanship of the House Judiciary Committee. He is to be replaced on the House Government Operations Committee by Congressman John Conyers of Michigan. Although nothing is likely to change in the first six months, there may be some, as yet unspecified, redirection of policy after that.

EXHIBIT III-7

TEN ISSUE AREAS THAT HAVE THE MOST EFFECT ON "GRAND DESIGNS"

1. Coordination Problems within the Agency during the Planning Phase
2. Procurement Problems during the Procurement Phase
3. Lack of Acquisition Skills during the Planning and Procurement Phases
4. Placing the Program High Enough in the Organization in the Planning Phase
5. Uncertain Funding during the Planning Phase
6. Audits by GAO during Planning and Procurment Phases
7. Problems with Contractors during Procurement
8. Staffing Problems during Planning, Procurement, and Operations
9. Problems with Procurement Regulations during the Procurement Phase
10. Unrealistic Time Schedules during the Planning Phase

Source: Table 2, Draft Report, *An Evaluation of the Grand Design Approach to Developing Computer-Based Application Systems*, GSA, Information Resources Management Service, July 1988.

2. Budgetary Constraints

Future-year funding of current acquisition programs and approval of funding for the next budget year are always in doubt in the federal government market. The authorization of an agency budget and the requested information resources by the agency oversight committee do not

assure the agency or vendors that funds will be provided in the out-years. Appropriation Acts for the agencies approve the TOA (Total Obligational Authority) for certain large systems, but not the fiscal year or years in which the funds will be available (called outlays).

Continuing economic and political sensitivity to the large national budget deficit could negatively impact a number of acquisitions in the "less than critical" defense and civil technology sectors. Presidential election years (1988) often imply budgeting for political, not practical, reasons, thereby leading to budget cuts in FY 89. Major ADP systems already approved are likely to continue in preference to unapproved programs.

Major civil systems affect service to the public and have greater political appeal than research programs. Deficit control measures, especially those under the Gramm-Rudman-Hollings (GRH) Act, could force agencies to cancel programs that do not meet stringent productivity improvement requirements and, in some cases, delay or stretch those that do. However, the Congress appears to be backing away somewhat from the GRH targets and most agencies have not yet had any major effect from the Act.

Systems acquisitions in the second half of the 1980s have been addressing needed improvements in management, administration, human resources, and logistics functions that have not received newer data processing resources in more than a decade. Administration decisions require complete data on domestic issues and regulatory affairs in order to satisfy congressional mandates. Agency executives need trend analyses and status reports that accurately portray funding, staffing, and performance progress against mission objectives. Required are accurate, up-to-date information management systems. The public, too, is pressing for solutions to delays and errors in processing payments and to delays in satisfying information requests.

INPUT expects budget difficulties to continue to constrain the federal information systems market. However, if the procurement process is simplified to reduce the protest volume, acquisitions should begin to increase. Many view informations systems as key to productivity increases. Therefore, budget constraints can sometimes lead to increased opportunities in the information systems market.

3. Computer Obsolescence

The issue of the government's computer systems obsolescence being significantly greater than the private sector's was recently brought into the spotlight by the release of a GSA study, *Computer Obsolescence: Federal Government and Private Sector*. Based on multiple sources of data, the study findings indicate that the government lags behind the private sector's Fortune 500 companies in terms of age and capacity of

equipment used to run critical systems. The study's comparison of the average age in 1986 for government and business large computers showed that the government's computers averaged seven years and eleven months, while the large computers of the Fortune 500 firms averaged only four years and two months.

The analysis also concludes that the Fortune 500 companies' larger computers process instructions approximately 3.7 times faster than the federal government's larger computers. On the average, the federal government's larger computers process approximately 3.19 million instructions per second. The Fortune 500 companies' larger computers process on the average approximately 11.89 million instructions per second.

Also in the GSA study, the four-year trend analysis indicates that the average age of large and very large computers peaked in 1983 and improvements seem to be appearing in the average age of the government's large computer inventory segment. The study's conclusions anticipate that in the future, however, the small- and medium-size equipment will contribute to the overall obsolescence of the government inventory of computers as the number of low-end computer categories increase. The federal government's need to modernize its obsolete equipment will lead to multiple replacements of large-scale systems, even when mission changes appear to be minimal.

4. Software Integration and Productivity Improvements

Software is the interface medium between machines, applications, and end users. Agencies need strategies and vendor support to implement these integrations. Agency respondents noted a growing need for portable software that is readily adaptable to a changing hardware environment. As new hardware technologies are put in place, the next generation of software must accommodate changes and communications between incompatible equipment.

Similarly, agencies are increasingly required to merge large applications into a single, transparent software system that fits the end users' needs rather than the end users adapting their needs to capabilities of the software. Simple, easy-to-use interfaces for making PC-to-mainframe applications are also urgently needed.

To modernize software and effect productivity improvement, agency ADP organizations are seeking greater use of:

- Software engineering technologies, including more-efficient software management methods, software development methodologies, and data dictionaries

- Higher level development tools, including program generators and fourth-generation languages

- Better analytic tools for all sizes of machines—microcomputers, minicomputers, and mainframes—that will provide programmers with development aids such as automatic documentation, cross-referencing, etc.

- Improved system software for supercomputers

One approach, data administration, provides techniques and software tools for arranging large amounts of data. By organizing, indexing, and cross-referencing data according to the business requirements of the organization, agencies are better equipped to plan procedures for the comprehensive development of future systems. Specifications from the American National Standards Institute (ANSI) are now being reviewed by agencies and vendors. Although a standard data dictionary software specification is some years away, vendors, especially vendors of Data Base Management Systems (DBMS), need to be cognizant of the pending impact of this trend.

Fourth-generation languages (4GLs) are being employed by agencies to increase productivity in software development and maintenance. Currently, 4GLs are used primarily for end-user computing and reports, along with some decision support. Other applications for 4GLs are being designed and will eventually ease the burden on agency staff and computer resources.

It has often been documented that 4GLs increase, sometimes sharply, equipment resource requirements. This comes from the inherent inefficiency—in a machine sense—of most 4GLs. As new software technology becomes available, agencies will likely optimize their code and increase machine efficiency. When this occurs, it could serve to dampen the growth in demand for large-scale systems.

5. Artificial Intelligence

Artificial intelligence (AI) is a market segment in which vendors are focusing on introducing new technology to the government primarily in the areas of software development efforts and decision support. Currently, expert systems are being developed by agencies as standalone end-user production systems to automate knowledge-based processing.

The DoD is taking the lead in developmental artificial intelligence programs. AI is providing useful training for analysts, and applications are being employed in tactical situations and support functions. Civil agencies are also developing and operating expert systems for large-scale information processing. In a previous report, INPUT determined that

decision-support systems represent the most common government application of AI.

Industry views the current AI opportunities to be in product-oriented services for prototyping systems for the federal agencies. As in other software areas, the government is looking to industry for solutions, not just products. Therefore, in response to this trend, AI vendors will migrate beyond standalone systems to new products that integrate approaches and solutions. AI will develop closer links to the main flow of an agency's information processing.

Many small AI vendors are focusing their marketing efforts on IS directors providing products to facilitate information storage and retrieval, data communication, and other typical management functions. Current federal prototyping efforts are demonstrating AI feasibility in those management functions as well as other decision support areas. Areas in which federal workers must interview the public seem especially promising for AI.

As agency demand increases, AI products are now starting to appear on mainframes. For example, IBM recently announced new products to run on its mainframe computers as well as its PCs. These include:

- Expert system environment tools
- Knowledge tool products
- IBM KEE, a product for IS professionals trained in AI applications

These products can be integrated with both IMS/VS and CICS/VS software.

D Federal Large-Scale Hardware Vendors

1. Leading Vendors

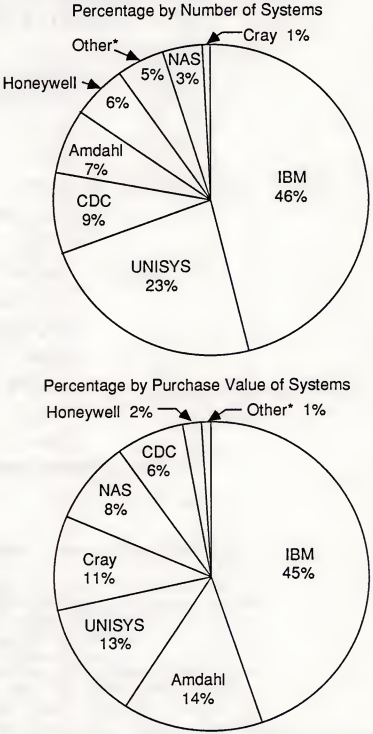
The leading vendors in the large-scale systems market are those offering large CPU-based systems with or without distribution networks. Other leading vendors offer supercomputer systems that are frequently the host for several mainframes. These may support distributed minicomputer and microcomputer terminals. Vendors that are providing these large-scale systems to the government agencies include many of the traditional computer companies. They also include newcomers that have entered the market with machines that incorporate much of the advancements in industry technology made over the last decade. Systems integrators are also playing an increasing role in the market. They offer upward-compatible systems to replace obsolete equipment or newer systems with enhanced capabilities. Competition for each large-system acquisition varies to some degree according to the projected value of the system, applications, sponsoring agency or end users.

Exhibit III-8 illustrates the estimated share of each vendor for their large systems currently installed at federal agencies. IBM with 46% and UNISYS with 23% have the highest shares. The other leading vendors vary in actual percents of installed systems and account for 26% of the installed base. The remaining small portion of the installed systems (5%) are comprised of equipment from the group of vendors listed in Exhibit III-9.

In comparison to the percentage of the market by number of systems, Exhibit III-8 also illustrates the distribution among vendors according to the purchase value of the systems. Again, IBM has the largest portion with 45%, but the remaining vendors have differing portions due to the type of hardware or nature of the system. Manufacturers of supercomputers would naturally have a higher percentage of purchase value for the fewer systems installed (i.e., Cray, NAS). Also, the systems differ from agency to agency in complexity, adding also to the changes in vendor share. This difference affects the percentages reported for companies such as UNISYS, Amdahl, and Honeywell. Furthermore, it should be noted that these figures only include systems classified as large-scale, and excludes systems that are comprised of mid-size equipment.

EXHIBIT III-8

VENDOR SHARE OF FEDERAL AGENCY INSTALLED LARGE SYSTEMS



*Vendors included in the other category are listed in Exhibit III-9.
Source: Computer Intelligence, September 1988.

EXHIBIT III-9

ADDITIONAL VENDORS SUPPLYING LARGE SYSTEMS TO THE FEDERAL GOVERNMENT

- CAMBEX
- Comp-Design
- CONVEX
- CSPI
- ELXSI
- Floating-Point
- Fujitsu
- Hewlett-Packard
- Intergraph
- Magnuson
- NCR
- Numerix
- Sky
- Xerox

2. University Supercomputer Facilities

In order to further the advancement of supercomputer technology and research, the federal government provides an estimated $20 million per year in federal funds for the operation and support of five National Science Foundation (NSF) supercomputer centers at universities and their connecting network, NSFnet. Each center is listed in Exhibit III-10, along with the area of research or computer-related expertise and the type of supercomputer installed. The centers were originally developed in 1985 and 1986 to provide state-of-the-art computational facilities for use by the scientific community for basic unclassified research. Presently several private corporations have formed research partnerships with the NSF supercomputer centers to test supercomputer applications and programs before securing large machines of their own.

EXHIBIT III-10

NATIONAL SCIENCE FOUNDATION SUPERCOMPUTER CENTERS

CENTER	LOCATION	AREA OF EXPERTISE	SUPER-COMPUTER
Center for Theory and Simulation in Science and Engineering	Cornell University	Parallel Processing and Software Productivity	IBM 3090-600E
John von Neumann Center (JVNC)	Princeton University	Data Archival	CDC ETA 10
National Center for Supercomputing Applications (NCSA)	University of Illinois	Graphics, Algorithms, and Applications	Cray
Pittsburgh Supercomputing Center for Advanced Computing in Engineering and Sciences (PSC)	University of Pittsburgh	Simulations, Interfaces	Cray
San Diego Supercomputing Center (SDSC)	University of California at San Diego	Oceanography, Microbiology, and Astronomy	Cray

The supercomputer centers have been very successful in their efforts and more users have become qualified participants to the institutions' facilities. The San Diego center has over 400 users while the Princeton University center has over 1,000 users and needed to add a second supercomputer to its operation. In addition to NSFnet, which connects all the centers, several regional networks have developed to link the centers to other college and university affiliates.

E

Foreign Vendor Market Presence

The major Japanese entrants into the supercomputer industry are Fujitsu, Hitachi, and Nippon Electronic Company. The Japanese are working to gain a foothold in the supercomputer market worldwide and are forcing the U.S. manufacturers to become increasingly competitive in terms of the price and performance features of their equipment. The Japanese

government is supportive of the companies' development of high-performance computers and promotes technological advances useful for increasing the Japanese market share.

There is not yet a significant installed base of Japanese computers in the federal agencies. In some cases, the Japanese supercomputers are working their way into federal large-scale computer systems via systems integration projects. For example, Fujitsu does not market its machines directly to the federal government, but uses OEMs and a distribution network. Another method is the use of traditional U.S. computer companies for marketing the Japanese machines. This is the procedure being used by NEC, which has begun marketing NEC SX supercomputers through Honeywell Federal Systems.

Federal User Requirements and Trends

The government's needs for large volumes of data and scientific and engineering applications have led many federal agencies to migrate to large computer systems. These systems, whether they are located at the agency's headquarters, computer facilities, research center, or across multiple sites, are becoming essential to supporting the agency's mission and most can be perceived as being a major system.

A *major system* is defined by OMB Circular A-130 as a system that requires special continuing management attention because of its importance to an agency mission; its high development, operating or maintenance costs; or its significant impact on the administration of agency programs, finances, property, or other resources. This section of the report discusses some of the issues involved with the federal agencies' current major large-scale systems and their operating environments, along with trends that will impact large systems in the future.

A Centralized Processing Role

1. Current Large-Scale Systems

Agency respondents were asked to estimate the number of mainframes and supercomputers currently installed in their agency's large-scale computer systems. Although the replies indicated a wide range of mainframes, the average total was 12. Agencies noted having 1 to 2 supercomputers when they had any supercomputers installed. Only respondents from Energy, Commerce, NASA, and HHS included supercomputers in their responses.

A wide range of models for mainframes are currently installed at the respondents' agencies. Exhibit IV-1 lists the various manufacturers and models of computers cited by agency respondents. Although mentioned by some agencies, this report does not include the VAX computers or the older IBM 4341s, which INPUT has classified as mid-size and separated into another INPUT report on the *Federal Mid-Size Computer Market.*

EXHIBIT IV-1

CURRENTLY INSTALLED MAINFRAME COMPUTERS FOR RESPONDENT AGENCIES

- IBM: 3081, 3084, 3090, 3094, 4341, 4361, 4381
- CDC: 840, 850, 1784, 3500
- Amdahl: 600E, 5880
- HIS
- Tandem
- IBM Compatible
- Gould 9050
- UNISYS: 1110/60, 1110/82, 1170, 1180, 1190, 1194
- NAS: 6650, 7000, 8083, 9000, 9050, 9080
- Honeywell 2150
- Burroughs

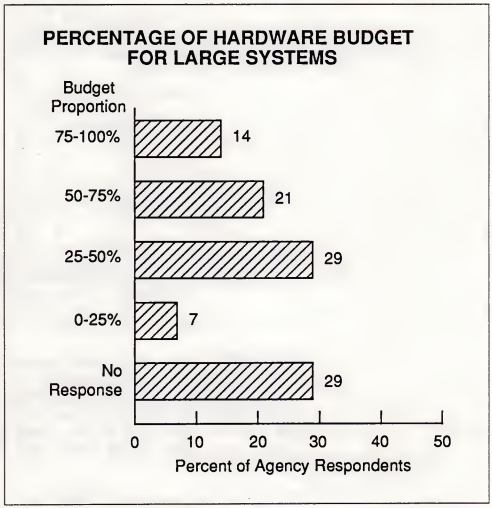
Presently, most of the government supercomputers reside in the Department of Defense, Department of Energy, NASA, and Commerce. The high-powered machines are being used in government laboratories and research environments, as well as agency computer facilities that are directed to support agency missions. The Class VI supercomputers in use today and the Class VII models being acquired offer scientific calculations, simulation, and modeling capabilities far more advanced than traditional mainframes.

The major computer manufacturers and companies supplying these machines to the government include Cray Research, CDC, ETA, NEC, and Hitachi. These companies are continuing in their efforts to produce the most technologically advanced machines and still remain competitive in terms of price and performance.

2. Agency Hardware Expenditures

Federal agencies spend varying amounts of their hardware budgets on mainframe computer equipment and supercomputers. The estimates for agency annual expenditures for the government agencies INPUT surveyed ranged from $1 million to $40 million. As shown in Exhibit IV-2, 29% of the respondents stated that their agency directed between 25% to 50% of their hardware budget to large-system hardware. Another 21% of the agencies spend an even higher percent as they reported spending between 50-75% of their budgets for hardware to support large systems.

EXHIBIT IV-2



3. Agency Environments for Large Systems

Exhibit IV-3 lists the type of agency environments in which the mainframe and supercomputers are utilized. Asked to describe the role within the department or agency and programs it supports, the most frequently cited environment or computer site is that of the research lab or R & D

site. Many of the mainframes are also serving as the source of computational support for the large data centers that the government operates.

EXHIBIT IV-3

LARGE-SCALE COMPUTER ENVIRONMENTS

GOVERNMENT ENVIRONMENT	RANK*
Research Lab/R & D	1
Data Center	2
Scientific/Technical	3
Mission Support	4
Financial	5
Processing	6
Administrative	7

* Rank based on frequency of mention.

The Veterans Administration serves as an example of a large system in which the agency's data processing centers are using mainframe processors to support a variety of agency information processes that serve several applications and mission-support functions. The VA operates four data centers in support of agency users. The centers are located at Austin, Texas; Hines, Illinois; Philadelphia, Pennsylvania; and Washington, D.C.

Each center provides computer operations support to specific communities of VA users. In addition, the Austin DPC manages the development and maintenance of major centralized fiscal applications, centralized management information applications, centralized patient treatment systems, and Message Switching Centers that are an integral part of the VA Data Transmission System (VADATS). Austin also provides nationwide timesharing services to all departments and staffs in support of the agency's VAccess end-user computing program.

Each of the data centers currently utilizes a wide range of hardware, software, and telecommunications products that are predominantly Amdahl, Honeywell, and IBM systems equipment. These multiple architectures have evolved over time as needs were identified and individual solutions pursued. As a long-range strategy, the VA will improve compatibility and interconnectivity of systems by reducing the number of combinations of hardware, software, and telecommunications protocols through rigorous planning and a structured acquisition review process.

Large-scale systems can also be categorized by the method in which the data bases are maintained or used. These proposed categories of systems are separated into the following system types:

- Centralized systems require shared access across organizational or geographical boundaries.
- Local applications require access by a limited number of users in a single site.
- Integrated local applications are limited-user, single-site systems that require sharing of data with other systems identified in the information architecture.
- Outside systems are used by the organization for data processing, and the information processed is owned and maintained by that organization, although the system is located within another agency, which owns the software and hardware.

Of these categories, centralized systems information requirements are most suitable for implementation on a mainframe computer. Outside systems, depending on the application or mission requirements, would also be likely to involve large-computer systems. Local applications, however, may now be shifting to mid-range systems unless the computer capabilities would be excluded.

4. Application Areas

In response to a separate question, nearly all agency respondents indicated that their large-scale computer systems supported their agency's mission. Many systems were dedicated to departmentwide efforts, whereas others were devoted to running applications for different services or agencies as a more specialized function.

Respondents were also queried on the types of applications that are being run on their large systems via mainframes and/or supercomputers. Exhibit IV-4 lists, in order of frequency of mention, the types of applications most prevalent on mainframes. Information analysis and management systems applications dominated the responses, followed by scientific/engineering application.

EXHIBIT IV-4

FEDERAL AGENCY RESPONDENT MAINFRAME APPLICATIONS

APPLICATION	RANK*
Information Analysis	1
Management Systems	2
Scientific/Engineering	3
Accounting	4
Administration	5
Logistics and Distribution	6
Human Resources/Payroll	7
Project Management	8
Electronic Mail	9

* Rank based on frequency of mention.

Information analysis will remain a major application area for large systems because the federal agencies must collect and process a large volume of information in order to effectively perform their programmatic activities. Much of the information, especially if it supports mission-related requirements, must be shared across functional and geographical boundaries.

Agency respondents are using supercomputers for scientific and engineering applications, along with complex modeling and computational functions. Certain government projects and areas of research have requirements for systems with extensive "number crunching" capabilities. The aeronautical and space design areas, weather forecasting, chemical processing/analysis, and defense planning activities all perform very complex calculations that would require an excessive amount of time if done on a traditional mainframe, but can now be accomplished speedily by supercomputers.

The development of supercomputers is also important because of the advanced computer design and its potential impact of the entire information system installed throughout each federal agency. Future application areas for supercomputers involve graphics and other areas of information analysis focusing on research and scientific developments and applications.

NASA makes extensive use of supercomputers and parallel processors for scientific research and engineering applications. The Ames Research Center at Moffett Field, California has two Cray-2 supercomputers that link 90 sites with over 800 users. The computers are used by the scientific community for research of fluid dynamics, aircraft design, and simulations.

The NASA Ames Research Center is seeking to upgrade one of its Cray-2 computers to a Cray YMP. Ames is also pushing the state-of-the-art technology for supercomputers by announcing its desire for a High Speed Processor-3 (HSP-3) computer system that will exceed .3 billion floating-point operations per second for computations.

Some of the other large computers in use by NASA for scientific research are as follows:

- Goddard Space Flight Center uses a Cyber 205 for atmospheric and oceanic modeling.
- Marshall Space Flight Center uses a Cray X-MP for research on tankage and space structures.
- Langley Research Center uses both a Cyber 205 and part of the Ames Research Center's Cray-2 for structural design and fluid dynamics research.

The need of high-speed computer capabilities at NASA will continue as additional space programs are implemented and exploratory missions are launched to acquire new scientific space-based data.

The Department of Energy and the Department of Commerce are two additional civilian agencies that lead the federal government in developing scientific applications for supercomputers. Exhibit IV-5 and Exhibit IV-6 summarize the areas within these two departments where supercomputers play a vital role in research and scientific calculations.

The Army serves as an example of continuous planning and efforts by a DoD agency to utilize the latest supercomputer technology. After first using supercomputers for many years through a timesharing arrangement, the Army has approved the purchase of seven supercomputers to be acquired over the next six years. To date, three Cray supercomputers

EXHIBIT IV-5

DEPARTMENT OF ENERGY'S USE OF SUPERCOMPUTERS

DoE PROGRAM/ SITE	FUNCTION/APPLICATION FOR SUPERCOMPUTERS
DoE National Laboratories	National Laboratories sites have approximately 25% of the federal government's supercomputers. Support energy-related computational problems, algorithms, and architectural research
DoE Nuclear Weapons Program	Research in atomic physics and modeling
DoE Defense Programs	Nuclear weapons research
Energy Research	Research in energy developments
Applied Mathematical Sciences Research Program	Advanced computation in energy sciences, mathematics, and computer sciences

have been installed. Two are housed at the Ballistics Research Lab (Aberdeen, MD), and the third at the Tank Automotive Command (Warren, MI). Although these supercomputers are installed at specific laboratories, they are accessible to users throughout the Army via the DDN or dial-up lines. Other Army units have purchased computer time on the machines through cross-servicing agreements. Most of the scientific research done on the supercomputers involves simulations.

EXHIBIT IV-6

DEPARTMENT OF COMMERCE'S USE OF SUPERCOMPUTERS

DoC PROGRAM/ SITE	RESEARCH AREA FOR SUPERCOMPUTERS
NOAA/Geophysical Fluid Dynamics Laboratory	Study of natural environment and atomospheric and oceanic dynamics
National Weather Service/National Meterological Center	Meterological analysis and forecasting
National Institute of Standards and Technology	Mathematical and physical calculations and scientific modeling

5. Large Computer Interfaces

Exhibit IV-7 summarizes the agency responses to questions about interfaces of their large-scale systems with mid-size and small-scale systems. The agencies surveyed primarily used local-area networks as the same interface method to connect their large computers with other systems. The Veterans Administration has its own VADATS network, which it employs for linking systems; other agencies are making use of their own inter-computer networks.

The micro-to-mainframe link can be as simple or complex as the user demands placed on the large system, or on the nature of the application. It appears that LAN interconnections are growing in popularity as they are viewed as the easiest kind of network linkage to use and are the most "transparent" and flexible. Also, several data base products are available that allow PCs linked to mainframes to easily manipulate data both on-line and off-line. Whichever interface is chosen, productivity and efficiency can be increased if the installed linkage allows for proper development of interactive communications with the mainframe and ease of automation for file transferring.

EXHIBIT IV-7

COMPUTER INTERFACES OF LARGE SYSTEMS

TO MID-SIZE SYSTEMS	TO SMALL SYSTEMS
• Local-Area Networks	• Local-Area Networks
• Channel and Inter-Computer Networks	• Electronic Mail
• HYPERchannel	• Hardware Systems
• Circuits and Switches	• VADATS X25 PDN
• VDATS X25 PDN	• Ethernet
• Ethernet	• CoLAN
• CoLAN	
• Wang VSs	
• Digital Computers	

6. Role of Systems Integrators

Agency respondents were asked to comment on the roles that contract system integrators perform in their agency's acquisition of large computer systems. The major involvement of systems integrators with the agency respondents included these tasks:

- Being on-site contractors
- Supplying systems
- Assisting with integration of systems

Although only 50% of the respondents currently have experience regarding contract systems integrators, several additional agencies foresee systems integration vendors playing an increasing role in future large-scale systems. The industry respondents that offer systems integration

services also noted more involvement with federal agencies in various capacities.

However, systems integration vendors need to invest more effort in understanding the agency's mission and its information resource requirements in order to find an appropriate system solution, rather than modify the requirements to meet an available solution. Agency policy officials voiced this concern repeatedly, as well as the GSA in its study of grand design systems.

B Software Selection Environment

1. Software Element of Large Systems

There is continuing pressure on agencies to contain costs of maintaining existing software, and, when that is not possible, to acquire software packages rather than create new custom software. However, due to the "specialized" nature of so many of these applications, agencies are still seeking custom software to satisfy their needs. INPUT's survey found that all of the agency respondents indicated some plans to continue to utilize custom application software in their computer operations. Application areas in which commercial software is now available and being used by agencies include: administrative, personnel, business, financial management, and some analysis.

In another INPUT study of the federal software and related services market, the results showed that agency respondents expect contract software maintenance acquisitions will increase along with packaged applications, custom applications, and packaged systems acquisitions. Custom systems software acquisitions will remain at their current level. In any case, mission-oriented software acquisitions are expected to grow at a faster rate than "general purpose" business software.

Federal agencies now are also active in procuring software and related services for supercomputers. Agencies cited as the most active in the acquisition of software for supercomputers include: Energy, NASA, Air Force, and Army. These agencies will continue to require new and modified applications software to support their missions. The extent to which software and related services are acquired from sources external to the user or the particular facility operator will be dictated to a large extent by future funding and politics. The scientific and engineering applications will most frequently be provided or developed by the user or an incumbent contractor.

2. Software Selection Criteria

Ratings of important factors in the selection of software for large computer systems are shown in Exhibit IV-8. Application functions topped the agency respondents' selection criteria and appeared second in the

ratings by vendors. The ratings for software features and support reputation were also strong by both the agencies and vendors. The extent of federal experience needed by the vendor was given the lowest rating. Therefore for software, the quality of the product and the positive image of the vendor superseded their government-related experience.

EXHIBIT IV-8

RATINGS FOR SELECTION CRITERIA— LARGE-COMPUTER SYSTEM SOFTWARE

SOFTWARE CRITERION	AGENCY RATING*	VENDOR RATING*
Application Functions	4.4	4.3
Software Features	4.1	4.3
Support Reputation	4.1	3.7
Ease of Implementation	3.7	4.3
Product Price	3.5	3.4
Federal Experience	2.9	2.7

*1 = Not Important; 5 = Very Important.

3. Use of Data Base Management Systems

In questions related to the use of either commercial or customized Data Base Management Systems (DBMS), the study of agency respondents indicated that 50% of those surveyed use a commercial DBMS for a variety of applications, some of which are unique to that agency. The other 50% will continue to use both commercial and customized data base management systems. While the "uniqueness" of an agency's application continues to support custom software development, there are growing indications that at the same time, vendors are offering more packaged features in their commercial DBMS and federal agency users are lessening these claims of uniqueness requirements.

4. Agency Software Requirements

Agency respondents were asked to identify any factors that generate special software requirements arising from their large system's interface requirements. The respondent factors reported are summarized in Exhibit IV-9. These are not ranked because the responses did not show a clear order of importance or popularity. However, the major focus of the interviewees responses is the importance of interconnectivity and adherence to standards.

EXHIBIT IV-9

INTERFACE REQUIREMENT FACTORS FOR SOFTWARE

- Interconnectivity
- NSC HYPERchannel Connectivity
- Interface with Other Agency Systems
- Relational Data Bases
- Communication Protocols
- Security and Trusted Computer Issues
- GOSIP

In another survey question, respondents were questioned as to whether or not there are any system architectures or software specifications that the federal agencies need to comply with for software development and acquisition. Sixty percent of the agency respondents indicated some specific area of compliance. The Army 3-Tier architecture and another "similar" DoD designed architecture was prevalent as a requirement among DoD respondents. The civilian agencies cited the FIPS PUBS and general federal computer standards as their basic requirements that dictate their software environment.

A final question relating to software was designed to obtain the agency respondents rating for the overall necessity of their federal organization to employ UNIX for their large-size computer operations through FY 1993. On a 1 to 5 scale, with 5 representing extreme necessity and 1

representing no necessity at all, the average agency rating was 2.66. This rating indicates that the current view regarding employing UNIX for large systems is slightly below average necessity, which might reflect a wait-and-see attitude of the majority of agency officials surveyed. Also, very few respondents mentioned any type of software designed to run UNIX outside of "microcomputers." Furthermore, no mention was made by any respondents of UNIX being employed with supercomputers.

C Application Environment

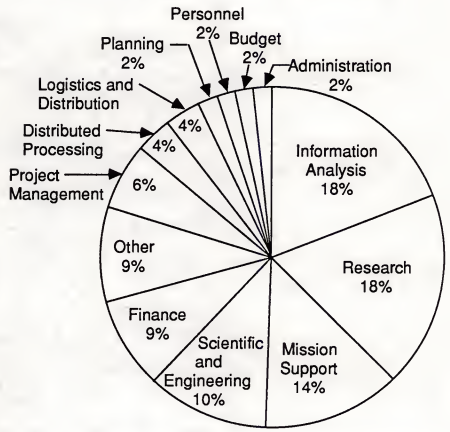
Exhibits IV-10 and IV-11 are compiled from the descriptions of federal computer systems and hardware acquisitions in INPUT's Procurement Analysis Reports. The applications include those from federal large-scale mainframe computer systems currently installed and from future planned procurements. The systems are at agency data centers, research lab facilities, departmental operations, and multiple sites throughout an agency. As might be expected, information analysis, scientific and engineering support, logistics, and mission support are the most frequent application areas for the defense agencies. The civilian agencies most often designated their systems for information analysis, research, and mission support, as well as other agency-specific applications. The results of the federal agency respondents environment and application areas for those large-scale systems surveyed are included earlier in this section of the report in Exhibits IV-3 and IV-4.

The primary application examples for the period FY 1988-1993 as identified in Exhibits IV-10 and IV-11 should be considered representative of large-scale systems only. The large share of information analysis and mission support in the civilian agency sample illustrates the shift to better automation of data collection and analysis by the agencies. The defense-oriented applications show continued growth in the area of logistics and distribution as well as scientific and engineering. Applications in the area of artificial intelligence are increasing, as agencies add expert system capabilities.

In another INPUT study of the relationship between the application and the type of program, it was revealed that major upgrades of current systems are planned for human resources, management, graphics, and logistics and distribution applications. Part of this thrust reflects an increasing awareness by agency executives of the uses of their information. Replacement of systems is most noted in office automation, information analysis, and scientific/engineering applications in which rapidly changing hardware technology continues to obsolete these systems at a fast pace. Some agencies have planned for new starts in the traditional areas of information analysis and administration. In general, these programs represent attempts to bring computer-based productivity improvements to the functional operations of the agency.

EXHIBIT IV-10

MAINFRAME APPLICATIONS FOR CIVIL AGENCIES

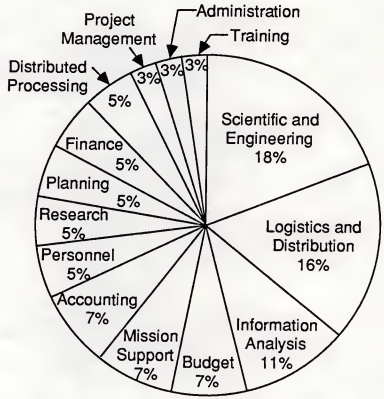


Source: INPUT's FISSP Procurement Analysis Reports.

The case studies that follow are intended to further illustrate the application areas that large-scale systems support in agency modernization and replacement efforts.

EXHIBIT IV-11

MAINFRAME APPLICATIONS FOR DEFENSE AGENCIES



Source: INPUT's FISSP Procurement Analysis Reports.

1. Case Study: Supercomputers/Scientific Applications

NASA and the Department of Energy are using supercomputers for establishing advanced computational capabilities in the area of science and engineering. The two descriptions that follow illustrate the extent to which supercomputers are relied upon by the research community.

a. Ames Research Center/NASA

Ames Research Center is developing the Numerical Aerodynamic Simulation (NAS) program to establish and maintain a leading-edge national computation capability. Through the NAS program, NASA intends to ensure leadership in computational fluid dynamics and related disciplines. Through continued state-of-the-art performance, researchers in computational fluid dynamics can address the next level of significant computational problems in the field of aerodynamics research.

Aerodynamics simulation represents one of the key emerging technologies that will strengthen aeronautics research. It will also develop technology toward promoting U.S. leadership in civil and military aviation. NASA is implementing the NAS program in stages. It will be implemented with a standard operating system, UNIX. This is particularly significant to the vendor community, since it takes UNIX out of its traditional small-to-mid-size environment. NAS will include high-speed processors, an integrated support processing complex, graphic workstations, and communications networks. It will be completely interconnected and provide users with a standard operating environment through the NAS Processing System Network.

b. Los Alamos National Laboratory/Department of Energy

The Los Alamos National Laboratory was founded in 1943 to design and build the first atomic bombs. Today it is operated by the University of California under a management and operating contract, and functions as a multiprogram research and development laboratory. The principal fields of research are theoretical nuclear, medium energy, plasma, and cryogenic physics; inorganic, physical, and nuclear chemistry; mathematics; metallurgy; life sciences and biomedicine; and earth sciences.

The Department of Energy's Los Alamos National Laboratory continues to be the site of advanced computing developments in support of scientific research and engineering. In the mid-1970s, the Los Alamos Lab was the test site for the first Cray supercomputer. The Lab currently operates four Cray X-MPs, four Cray 1s, three CDC Cyber 825s, and two CDC Cyber 855s.

The DoE has planned since 1983 for the acquisition of two Class VII supercomputers to provide the needed additional computing capability for the weapons programs at Los Alamos National Laboratory. The Class VII supercomputer is the next generation of supercomputers. An example of an enhanced Class VI supercomputer, according to DoE, is the Cray X-MP 416. DoE is "waiting for a breakthrough" in supercomputers and has set the criteria for a Class VII computer to have approximately 4 to 10 times the capability of the current Class VI computers. The agency is still awaiting the availability of Class VII computers.

2. Case Study: Modernization of IRS Tax System/Information Processing and Analysis Applications

The Internal Revenue Service's Tax System Redesign program serves an example of a modernization effort for a governmental large-scale system which focuses on information processing applications. The current system dates back to the late 1950s and relies heavily on manual- and paper-intensive processes. This older system is not capable of fully servicing the increasing demands for timely and readily available access to tax account data.

The IRS initiated the project in 1982 and focuses on these four objectives:

- Obtain faster access to tax payer information;
- Obtain state-of-the-art computer and telecommunications technology;
- Achieve automation of manual- and paper-intensive processes; and
- Achieve better connectivity for related information.

Early estimates of the cost for the redesign amounted to approximately $1 billion for fiscal years 1989 through 1992, and between $4 to $5 billion during the life cycle of the system through the 1990s. However, the scope of the redesign was expanded to include additional initiatives, so the funding remains subject to change.

This program proposes funding for the acquisition of the required hardware, software, and services to redesign the national automated tax processing system. Specific requirements will not be identified until the IRS has an internally approved acquisition strategy. The program office expects to use multiple procurements to meet the needs of this initiative.

Tax processing is built on a batch-oriented process, which does not make information available to all functions of IRS in a timely manner. The current system is an antiquated collection of separate, complex, and interdependent data processing systems that separately extract data from tax returns, validate return data, account for tax payments, refund, and amounts owed, and provide limited information on-line.

Presently, tapes that contain summary tax return data are shipped by air to the National Computer Center in Martinsburg, WV, from each of 10 IRS service centers to update the master file of tax data. The master file data is also stored on tapes, which makes the information difficult to access. Furthermore, in order to reply to taxpayer inquiries, selected information is extracted from the file, put on magnetic tape, and flown directly to the service center, which is also a time-consuming process.

In recognition of the inefficiencies and difficulties associated with its aging tax processing system, the IRS assigned organizational responsibilities and designed a management plan to provide a framework for the redesign efforts. Exhibits IV-12 and IV-13 highlight the plan and outline other present accomplishments and planned initiatives.

EXHIBIT IV-12

IRS TAX SYSTEM REDESIGN PROGRAM PROGRESS TO DATE

- Established Mangement Framework
  - Redesign Official's Role Defined
  - Offices Formed to Manage the Redesign
- Initiated Contractor and Other Outside Technical Assistance In:
  - Design Concept and System Engineering
  - Data Planning and System Documentation
  - Current and Advancing Technologies Assessment
- Initiated Technical Enhancements for the Interim and Target Architectures
  - Modified or Developed Standards for Key Aspects of System Life Cycle Activities
  - Acquired Automated Project Management Tool
  - Initiated Plans for Cost/Benefit Analysis, Security Measures, and Acquisitions
  - Assessed Available Technology
  - Made and Tested Prototypes of Systems

EXHIBIT IV-13

IRS TAX SYSTEM REDESIGN PROGRAM PROPOSED PLANS

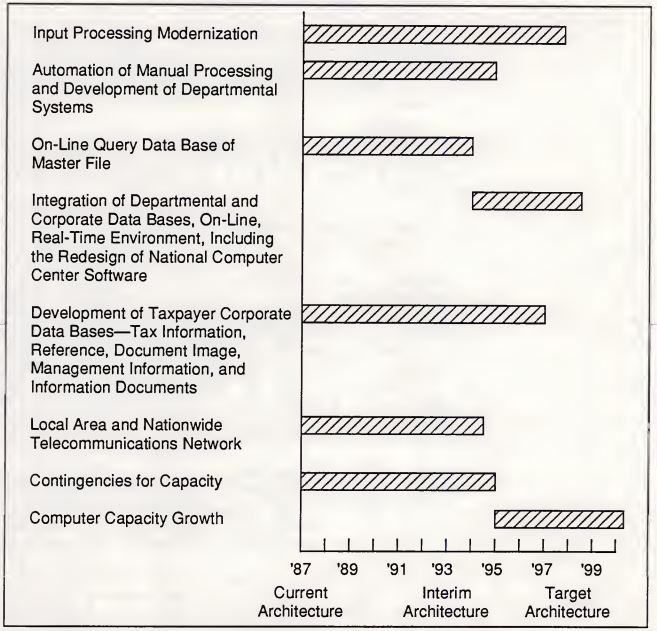
- Major Technical Enhancements—Interim Architecture by 1994
  - Modernize Input Processing and Storage
  - Develop Departmental Systems
  - Convert Data from Sequential Tape to Direct Access Media for a Query Data Base Environment
  - Develop Local-Area Networks
- Major Technical Enhancements—Target Architecture by 1998
  - Continue to Modernize Input Processing
  - Develop a Corporate Data Base in an On-Line, Real-Time Environment
  - Install a Nationwide Telecommunications Network

The magnitude of the tax data associated with the IRS system is somewhat staggering and has strongly influenced the design and requirements of the proposed modernized system. Currently, the active weekly batch of tapes going to the Martinsburg computer facility averages between 2,000 to 2,500 reels. With the modernization, the IRS proposes to convert from magnetic tape to direct access media, develop several departmental systems, modernize input processing and storage capabilities, and develop LANs. The proposed timeframe for each of these major areas of initiatives is identified in Exhibit IV-14.

The IRS plans to incorporate state-of-the-art computer and telecommunications technology in the modernization project. Included among the technologies to be employed are:

EXHIBIT IV-14

IRS TAX SYSTEM REDESIGN PROPOSED TIMELINE FOR MAJOR TECHNICAL ENHANCEMENTS



Note: Effective as of January 1988. These dates may change as new technologies become available and as IRS proceeds with and adjusts the plan.

Source: *ADP Modernization, IRS' Tax System Redesign Progress and Plans for Future, Briefing Report to Congressional Requesters,* GAO/IMTEC-88-23 BR, April 1988.

- Expanded electronic filing mechanisms for tax returns and tax information
- Optical scanning devices to read and capture tax data
- Optical disks to store and process information

Also, one of the objectives of the program is to develop new computer software to replace the millions of lines of assembler language code that is still being used at the National Computer Center. This software will support the proposed corporate data bases and on-line real-time updating processes for tax information.

Currently, the program office is developing detailed project plans. The information in these plans will be available in the RFCs and RFPs to be issued over an 18 to 36 month period. A vendor briefing is expected to be held in the last quarter of 1988.

3. Case Study: Replacement of Large-System/Mission-Support Applications

The Air Force Logistics Command is initiating the Contracting Data Management System - Phase II (CDMS), which will replace the outdated procurement data processing system hardware suite, more efficiently support the agency's contracting mission, and modernize HQ AFLC and the five Logistics Commands nationwide. Phase II of CDMS provides for the design, development, prototyping, and installation of a single AFLC-wide system to support the central contracting mission. CDMS will track and maintain pre- and post-contracting actions, measure workload, complete deliquencies, provide financial management information, and forecast the contractual deliveries status.

The program calls for the complete modernization of the procurement data processing at AFLC and will eventually replace the existing outdated hardware suite. The present hardware consists of a CDC Cyber 177/30, some Burroughs and Data General equipment and a few other "outdated" machines. There is also an IBM 3081 that runs under MVS.

Phase I of the CDMS program was to set up a foundation system. The contract for Phase I was awarded to Integrated Microcomputer Systems (IMS). Phase II will require a large mainframe with a resident data base, a maximum of 50 intelligent terminals at two Air Logistics Centers, and four main operating bases with hardcopy and storage capabilities. Also to be provided are communications to link the system software, applications software for technical order (TO) processing, and maintenance of both hardware and software.

A program restructuring recently occurred, which caused the Phase II schedule to slip. An RFP is expected in early FY 1990 and full operating capability is anticipated for 1994. The program is estimated at $93 million over an eight-year period.

D

Impact of Governmental Policies and Regulations

Many large-scale computer systems are subjected to a range of agency policies, regulations, and other influences. Therefore, the agency respondents were surveyed to obtain their views on how several government regulations and initiatives impact their agency's large-scale systems acquisitions through 1993. Exhibit IV-15 shows each initiative studied, and the responses of agency officials.

In general, respondents did not view the present FIRMR and any proposed changes to the regulations as having a major impact on system acquisitions. The Competition in Contracting Act (CICA) has brought about some impact in a variety of ways, both positive and negative. Also, further implementation of the Trail Boss Program and compliance with emerging standards are viewed very favorably by the respondents.

EXHIBIT IV-15

RESPONDENT VIEWS ON IMPACT OF GOVERNMENT POLICIES

FIRMR

- Extended Acquisition Lead Time
- Enforces Life Cycle Costing
- Requires Proper Planning
- Continues Paper Overload

CICA

- Increased Competition
- Lengthened Procurement Process
- Initiated Additional Protests
- Impacted Specifications and Requirements

Trail Boss

- Improved Training for Acquisition Managers
- Benefitted Projects
- Moved toward Adopting Team Approach to Trail Boss Program
- Requires Incentive to Keep Same Boss on Project

Standards

- Viewed as Critical to OSI
- Needed for Interconnectivity and Interoperability
- Requires FIPS PUBS to Keep Pace with Technology
- Support of GOSIP as an Important Standard

E

Acquisition Plans and Preferences

1. Acquisition Plans

Eighty percent of the respondents indicated that their agencies would be adding in-house computers over the next five years. Respondents indicated that the additional computers would include mid-size and small computer systems, as well as mainframes and supercomputers. These additional computers will support the applications shown in Exhibit IV-16, along with the current applications for the large-scale systems indicated previously in Exhibit IV-4.

EXHIBIT IV-16

MAJOR APPLICATIONS TO BE SUPPORTED BY ADDITIONAL COMPUTERS

- Data Distribution
- Logistics Systems
- Statistical Analysis
- Project Management
- Contract Production
- Management Systems
- Administrative Applications
- Business Applications
- Office Automation

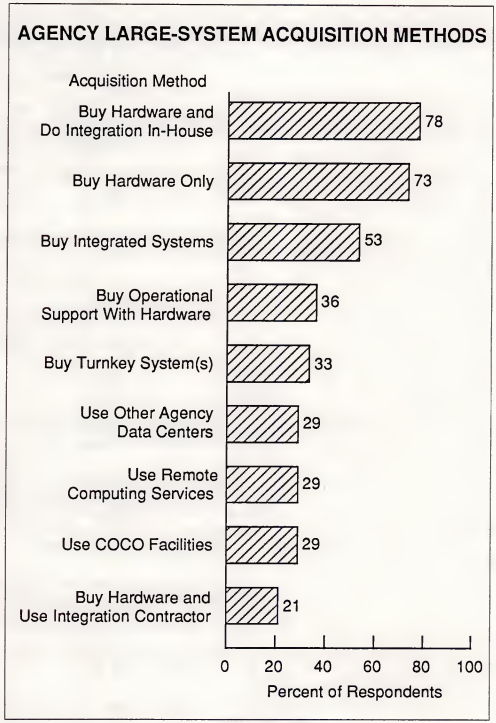
Agency respondents were also queried on whether they have plans to expand, upgrade, or replace any of their current computer systems during the next five years. Two-thirds of the respondents indicated that the agency would be changing their computer system via one or more of these methods. The expansions or upgrades to the system are to meet expanded workloads, add database applications, or extend other current applications.

2. Method of Acquisition

Agency respondents were asked to comment on the method by which they plan to accomplish any changes or additions to agency computer systems. The respondents gave multiple replies as to which of the system acquisition methods they will be using, as identified in Exhibit IV-17. Over three-fourths (78%) of the respondents stated that they expect to buy hardware and do integration in-house. This is surprising in light of the shortage of qualified technical talent in the government. Half of the agency personnel interviewed plan to buy integrated systems and over one-third indicated that their agencies purchase operational support along with the hardware acquisition.

These findings suggest a wide range of opportunities for large-scale hardware vendors. In some cases, only hardware will meet agency needs. In other cases, some kind of value added will be required, either through systems integration or operational support. Multiple responses indicate that agencies expect a variety of solutions, depending on their particular needs.

EXHIBIT IV-17



3. Vendor Selection Criteria

The ranking by agencies as to which criterion is most important in the selection of a large-system/hardware vendor is shown in Exhibit IV-18. Bid selection criteria, although varying among agencies and even among specific projects within each agency, usually involved:

EXHIBIT IV-18

SELECTION CRITERIA SIGNIFICANCE FOR HARDWARE/LARGE-SYSTEM CONTRACTORS

RANK	CRITERION
1	Technical Solution
2	Life Cycle Cost
3	Risk Containment
4	Contract Type
5	Initial Cost

- Proposed technical solution; that is, the extent to which the proposed solution meets the requirements.

- Cost, although this is considered by contracting personnel as a primary criterion only when two or more vendors propose similar approaches or equipment. Vendors continue to complain that the government gives "lip service" to total life cycle costs but really buys on the basis of front-end costs.

- The type of contract; As discussed earlier, the contract should be such that the agency has some assurances that costs and/or delivery schedules will not be overrun.

- Risk containment procedures, including adequacy of reporting schemes and progress reports.

The technical solution is identified as the primary criterion for selection by the agencies. Life cycle cost is listed as the second most important criteria. Agency respondents also mentioned risk containment as an important factor, reflecting a growing concern over systems for which they have assumed responsibility as systems integrators.

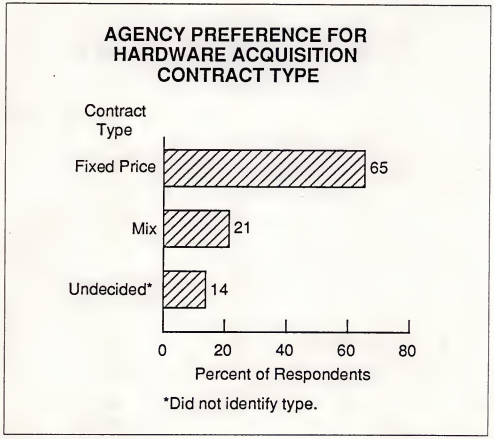
Vendor experiences tend to be somewhat at odds with this finding. As explained in Chapter V, most vendors view life cycle cost as the primary

selection criteria. The difference in opinions probably comes from the types of agency personnel interviewed. The majority of respondents were users or policy officials. Although INPUT regularly attempts to question more contracting officers, these officers generally show more reluctance to participate in surveys. However, when awarding a contract, they also show great reluctance to choose someone other than the lowest bidder.

4. Contract Preference

The questionnaire attempted to provide some indication of the trend in the contract types used by federal agencies for large system computers. As Exhibit IV-19 depicts, fixed-price contracts are chosen most frequently for hardware acquisitions and will probably continue to be used. Respondents' reasons for preferring to use fixed-price contracts included cost control, ease of management with suppliers, and reflection of the agency's policy to reduce government risk. Other contract types, particularly incentive-based, will be used only as required by specific programs.

EXHIBIT IV-19



F

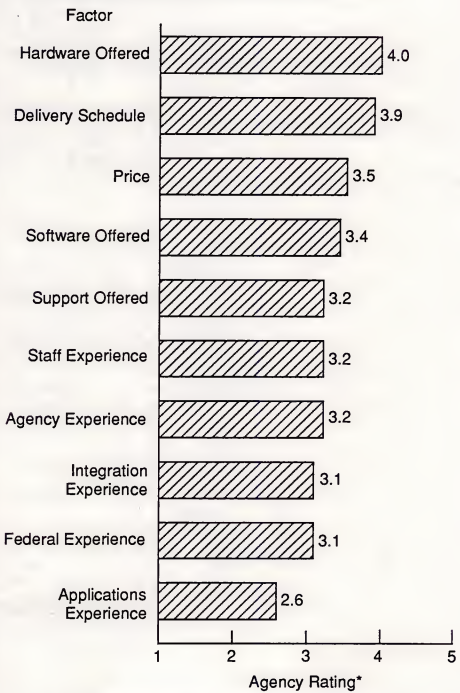
Vendor Performance

1. Agency Satisfaction Level with Vendor Performance

The overall level of satisfaction of agency respondents to vendor performance characteristics is moderate for most factors. Exhibit IV-20 reflects the rating responses given to each factor and indicates that the hardware offerings were viewed as the highest area of satisfaction for vendor performance. The survey results also suggest that the agency respondents are reasonably satisfied with the delivery schedule and price for large-scale computer systems hardware. The responses also indicate a somewhat lower level of satisfaction regarding the vendor's application experience. This may improve, however, as vendors become more familiar with the agency's applications that are unique to their missions or agency operations of large systems.

EXHIBIT IV-20

AGENCY RATING OF VENDOR PERFORMANCE CHARACTERISTICS

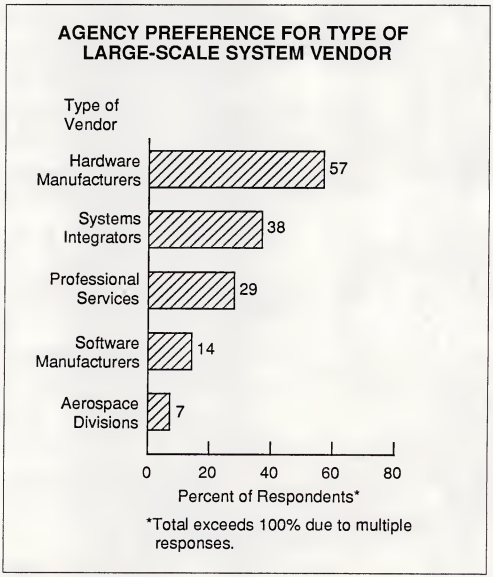


* Ratings: 1 = Performance Not Satisfactory;
5 = Outstanding Performance

2. Preference for Type of Vendors

Agency respondents were asked which type of vendor appears more preferable for providing appropriate large-scale systems for their agency, as shown in Exhibit IV-21. Over 50% of the agencies preferred hardware manufacturers and stated that these vendors are more responsive to meeting a variety of agency requirements with their products and also provide product support as needed.

EXHIBIT IV-21



The next largest share (38%) of the respondents preferred systems integrators due to their flexibility in providing the agency with various options and in assuming responsibility for the system. Presumably, agencies do not believe that all federal vendors are capable in all areas

that support large systems. Rather, they view vendors according to the vendor's own focus and prefer to match that focus to the requirements of the system.

In a related question, the respondents were asked what impact, if any, foreign manufacturers will have on the federal large-scale market. Roughly one-third (36%) of the respondents were of the opinion that foreign competition would definitely have an impact and would probably improve prices and performance for mainframes and supercomputers. Another 21% viewed the impact as "minor." The largest share of the respondents, 43%, were not sure of any impact or had no response.

3. Future Suggestions for Improvements to Vendor Products and Services

Agency respondents were queried on their suggestions for how vendors might make their hardware products and services more valuable to the federal government over the next five years. As should be expected, the replies varied due to the different types and levels of experiences the respondents have encountered with vendors.

In descending order of frequency of mention, Exhibit IV-22 lists the principal suggestions made by the civil agencies. Improvements in adherence to industry standards was cited most frequently, as well as increased industry support for GOSIP and POSIX. Also mentioned was a need for increased flexibility by vendors as to the contract terms and prices.

These findings are fairly consistent with the previous question on vendor performance characteristics. Agencies are, in general, more concerned with standards and pricing and less concerned with agency and application understanding. However, the low rating for applications experience in the earlier exhibit shows that this area still represents an issue with many respondents.

4. Agency Perception of Vendor Teaming Relationships

Interviews with agency representatives also solicited responses to the question of how effectively vendors completed teaming arrangements. Based on their agency's current and past procurement experience, agency respondents were asked to rate the overall success level of vendor (hardware, software, professional services vendors, etc.) teaming relationships. Using a 1 to 5 scale (where 5 means extremely successful and 1 means not successful at all), the average rating was a 2.9 from the respondents. This rating reflects a need for improvement in teaming activities.

EXHIBIT IV-22

AGENCY SUGGESTIONS FOR IMPROVEMENTS TO VENDOR PRODUCTS AND SERVICES

SUGGESTION	RANK*
Increase Adherence to Industry Standards	1
Increase Flexibility of Contracts and Prices	2
Increase Support for GOSIP and POSIX	3
Lower Software Costs	4
Increase Familiarity with System Requirements	5
Increase Cooperation and Responsiveness to Agency Needs	6

*Rank based on frequency of mention by respondents.

To supplement the rating, the survey asked for comments on how the teaming relationship(s) can be improved. These suggestions are summarized in Exhibit IV-23. The teaming process from the agency perspective needs greater lines of communication, increased cooperation and more experience from the participants staff.

EXHIBIT IV-23

AGENCY SUGGESTIONS FOR IMPROVED TEAMING RELATIONSHIPS

- Improve Communication among All Vendors and Users
- Increase Cooperation among Vendors
- Improve Staff Experience and Competency
- Utilize More Formal Arrangements
- Increase Enforcement of Prime Contractor's Responsibility
- Extend Involvement of Peripheral Dealers with Manufacturers

G

Trends

1. Industry Trends

The agency respondents were also asked to identify specific industry trends and non-technical factors that could significantly impact the agency's computer system plans. Exhibit IV-24 summarizes the agency responses. Most of the respondents identified the increased role of systems integrators in the market. Also, there was mention of more commercial operations of government data bases or privatization occurring in the government market. Furthermore, agency respondents were concerned with the general economic conditions and budget limitations.

2. Budget Constraints

Sixty-seven percent of the agencies surveyed said that they experienced budget constraints attributable to the Gramm-Rudman-Hollings Act or other federal government budgetary constraints. Some agencies have suffered major delays and cutbacks in acquisitions, while other agencies have downsized levels of support and slowed their modernization efforts. Several agencies commented that at present they have encountered a minimal amount of budgetary constraints, but foresee more significant funding restrictions in the future.

EXHIBIT IV-24

INDUSTRY TRENDS IMPACTING LARGE-SCALE SYSTEMS

TREND/FACTOR	RANK*
Increased Use of Systems Integrators	1
Increased Privatization	2
Economic and Budget Constraints	3
Availability of Skilled Staff	4
Availability of Functional Applications	5

*Rank based on frequency of mention by respondents.

3. Technology Trends

Agency representatives were asked to identify technological factors that could or might affect their agency's large-scale system requirements through FY 1993. Eighty percent of the respondents anticipate some impact from technological developments. Numerous factors were identified and those mentioned most frequently are listed in Exhibit IV-25.

A majority of the respondents identified increased computing power of microcomputers as the most important factor affecting future mainframe usage. Expanded networks, especially local-area networks and distributed processing network availability, were considered almost equally important factors. The remaining factors include suggestions for intersystem compatibility, implementation of OSI, and advancements in software that could serve to promote greater utilization of large systems.

EXHIBIT IV-25

TECHNOLOGICAL TRENDS AFFECTING LARGE-SCALE SYSTEMS

TREND/FACTOR	RANK*
Increased Microcomputer Capabilities	1
Expanded Networks/LANs	2
Distributed Processing Networks	3
Advancements in Software/4GLs	4
Inter-system Compatibility/OSI	5
Optical Disk Storage	6

*Rank based on frequency of mention by respondents.

With regards to technology trends that could have an impact on the government's use of supercomputers, Exhibit IV-26 lists the future changes in technology most likely to affect agency operations and applications directed to supercomputers. Each generation of supercomputer builds on the high-performance characteristics of the last and incorporates advances in new architectures and processing mechanisms. Also adding to the design of the next generation machine are improvements in programming languages and other software developments that apply to large-scale computer system computational abilities.

EXHIBIT IV-26

TECHNOLOGICAL TRENDS AFFECTING SUPERCOMPUTERS

- Advancements in Parallel Processing
- LAN Speeds/Bandwidths
- Media for Data
- Increased Capacity of Storage Disks
- Decreased Machine Cycle Times
- Developments in Superconductivity
- Improvement of Synchronization Mechanism

Competitive Trends

A

Vendor Participation in Federal Market

Vendors that compete in the large-scale systems market offer many services in addition to mainframes and supercomputers. Exhibit V-1 shows the products and services that vendor respondents currently provide to the federal agencies.

EXHIBIT V-1

VENDOR PRODUCTS AND SERVICES PROVIDED FOR LARGE SYSTEMS

PRODUCT/SERVICE	PERCENT RESPONDENTS
Mainframe Computers	85
Supercomputers	57
Other Computer Hardware	57
Hardware Maintenance	85
Software Maintenance	85
Consulting	85
Systems Integration	85
FM/Operational Support	57
Programming and Analysis	72

Mainframe computers, hardware and software maintenance, consulting, and systems integration services are offered by the largest percentage of respondents. In the future, several vendors noted that they may offer supercomputers and others may increase their systems integration activities.

The types of systems integration functions that the vendors have already performed for agencies with large systems are shown in Exhibit V-2. The vendor respondents reported a wide variety of functions that are normally characterized as systems integration.

EXHIBIT V-2

FUNCTIONS PERFORMED AS SYSTEMS INTEGRATOR

- Requirements Planning
- Software Development, Acquisition, and Support
- Maintenance
- Communications Support
- System Installation
- Provision of Interfaces
- System Architecture and Design
- Development of Tests and Evaluation Procedures
- Total Life Cycle Support
- Software Conversion

The extent to which federal large-scale system hardware and services contribute to the industry respondents' overall hardware segment revenues varied widely among participants in the study. This wide variation is due to many of the respondents being a "federal group" and dealing 100% in the large-scale market, while other respondents estimated that 5-10% of their hardware revenue was attributed to the federal agencies.

In another question, the federal vendors were asked whether their companies offered operational support in connection with federal large systems. Approximately 50% of the respondents identified operational support as a service they provide to government agencies. The percentage of contracts in which this support was provided fall into two groupings: vendors with operational support in 90% or more of their contracts, and respondents that provide support service in only 10-25% of their contracts.

A four-year trend analysis of federal contracts for ADP equipment and services awarded to selected hardware vendors is compiled in Exhibit V-3 for fiscal years 1984 through 1987. The dollar amounts depicted are obligations for contracts awarded in that year as a prime contractor only from selected federal supply codes. The amounts do not reflect total sales revenues for any category of equipment offered by these companies (i.e., mainframes or supercomputers), except where only one product is offered by the company.

EXHIBIT V-3

SELECTED HARDWARE VENDORS' FEDERAL CONTRACT AWARD OBLIGATIONS— ADP EQUIPMENT AND SERVICES FY 1984 - FY 1987

COMPANY/ PRIME CONTRACTOR	$ THOUSANDS			
	FY 84	FY 85	FY 86	FY 87
IBM	100,715	351,183	218,143	194,423
UNISYS	111,873	99,717	139,848	238,134
Control Data Corp.	31,740	79,217	73,969	69,602
Honeywell	26,665	48,205	36,170	37,995
Cray Research	20,066	22,976	19,187	79,215
VION Corporation	5,043	6,370	8,860	25,675
Amdahl Corp.	6,150	18,334	4,672	10,095
Total All Contractors	867,168	1,393,007	1,559,951	2,059,929

Notes:

- Federal contract data for selected federal supply codes for ADP equipment and services as reported for prime contractors only.
- ADP equipment includes all range of products supplied to government and not limited to large scale equipment.

Source: Federal Procurement Data Center.

In all but FY 1987, IBM received the highest share of obligated dollars from reported federal ADP equipment and services procurements. UNISYS was the next-largest federal vendor, followed by Control Data Corp. The totals for both Cray Research and Amdahl Corp. reflect these companies' stronghold in the large-scale computer system (supercomputers) market. Vion Corp. is noted for its distribution of NAS large-scale computers.

In general, the companies involved do not provide a breakout of their revenues by system type. Further, many federal revenues are obtained by the vendors as subcontractors. It may be somewhat more useful to compare inventory information for the various vendors. Exhibit V-4 shows a breakout of central processors in the government, based on purchase value. This Exhibit, from GSA's inventory summary, is not consistent with that of *Computer Intelligence* because sampling methods differ and, while *CI* uses residual value, GSA uses purchase value. However, Exhibit V-4 does provide useful information for comparing market penetration among leading vendors. Since GSA does not breakout large-scale from mid-size systems by manufacturer, the exhibit contains both.

B

Vendor Market Perceptions

The majority of respondent vendors provide their products and services to both the DoD agencies and the civilian agencies. In response to the question of which agencies can be identified as the best opportunities for their company in the large-system market, the major defense agencies and several large civilian agencies such as NASA and Energy were mentioned most frequently, as shown in Exhibit V-5.

EXHIBIT V-4

DISTRIBUTION OF DOLLAR VALUE AND COUNT FOR SELECTED ADPE CATEGORIES BY MANUFACTURER

MANUFACTURER	DOLLAR VALUE	CENTRAL PROCESSORS		
		PERCENT	COUNT	PERCENT
Sperry Information Systems	486,216.2	14	2,304	8
IBM	478,391.0	13	2,373	9
Digital Equipment Corp.	620,486.5	17	5,288	19
Honeywell	241,307.8	7	1,376	5
Control Data Corp.	299,597.5	8	318	1
Cray Research, Inc.	248,764.8	7	27	0
Amdahl	174,611.9	5	99	0
Wang Laboratories, Inc.	57,704.2	2	1,167	4
Data General Corp.	79,662.9	2	907	3
Hewlett-Packard Company	86,066.5	2	1,675	6
Other Manufacturers	776,188.2	22	11,838	43
Grand Totals	3,548,937.5	100	27,372	100

Total ADPE Dollar Value ($ Thousands): $7,821,198.2

Total ADPE Count: 301,957

Source: *Automatic Data Processing Equipment in the U.S. Government, First and Second Quarter FY 1987 Summary,* Federal Equipment Data Center, General Services Administration

EXHIBIT V-5

VENDOR PERCEPTION OF AGENCY OPPORTUNITIES FOR LARGE-SYSTEM PRODUCTS AND SERVICES

DoD AGENCIES	CIVILIAN AGENCIES
Army	NASA
Air Force	Energy
Navy	Treasury
DIA	SSA/HCFA
	HUD
	Justice

The industry respondents were also polled on which applications their mainframe systems support. As might have been expected, information analysis, logistics and distribution, and scientific applications were the most common replies. The applications offered by the vendors listed in Exhibit V-6 closely parallel the mainframe applications cited by federal agency respondents, with the exception of logistics being mentioned less frequently by the agencies.

The applications on supercomputers being supported by the vendors were all scientific and engineering in nature. For the future, it is anticipated that supercomputers will support more graphic applications as well as other functions to support agency missions. These additional applications will evolve as the machines' technologies change and advancements in software are implemented.

The vendors surveyed by INPUT projected that the large-scale market will change over the next five years. Most of the perceived changes listed in Exhibit V-7 are favorable to the industry. Increased supercomputer acquisitions and increases in mainframe communications and distributed processing system could favorably impact several vendors. The view that there will be fewer but larger procurements is one factor that tends to make the large-scale market increasingly competitive.

Vendors are providing a wide array of software products and services that are essential to operations of the federal government's large-scale

EXHIBIT V-6

APPLICATIONS SUPPORTED BY VENDOR MAINFRAMES

APPLICATION	PERCENT RESPONDENTS
Information Analysis	86
Logistics and Distribution	86
Scientific/Engineering	86
Management Systems	71
Administrative Functions	57
Project Management	57
Accounting	57
Graphics	57
Human Resources/Payroll	57
Word Processing	57
Electronic Mail	57
Electronic Publishing	29
Planning	14
Training	14
R & D	14
Communications	14

EXHIBIT V-7

VENDOR-PERCEIVED CHANGES IN LARGE-SCALE SYSTEMS PROCUREMENTS

- Increase in Supercomputer Acquisitions
- Increase in Workstations
- Larger and More Lengthy Acquisitions
- Increase in Mainframe Communications and Distributed Processing Systems
- Increase in Expenditures by Civilian Agencies (Shift from DoD)
- Increase in Replacements of Obsolete Equipment
- Fewer Large Procurements with Combined Requirements

systems. In general, federal agencies acquire the software they use in one of the following ways:

- Purchase with the hardware suite in turnkey systems buys or system integration programs
- Purchase "off-the-shelf" packages from the software vendor, either as a standalone purchase or as part of a hardware purchase
- Purchase custom development of software that represents a new software product (generally referred to as "programming and analysis" or software development)
- Purchase custom modifications of software already in use by the agency (generally referred to as "software maintenance")

Agency funding requests, planned initiatives, and regulatory changes all point to a fairly robust market for software development services and software products, which accompany large systems.

For fiscal years 1988 to 1993, it is anticipated that the expenditure growth rate for software products will exceed that for software develop-

ment through the forecast period. Agency budget constraints are forcing more packaged software acquisition, at the expense of custom software development. Vendors are more frequently including in their products those functions that have previously forced agencies to seek custom solutions. At the same time, agencies, under funding pressure that forces them to justify the cost effectiveness of the software solution approach, are "perceiving" fewer unique requirements. The net result of these two events is a greater attractiveness of off-the-shelf software.

The attractiveness of the federal software market and the diversity of the agencies' needs have swelled the competitors' ranks. Eighty-five percent of the industry respondents provide software maintenance in conjunction with their other services for large systems.

In addition to competition on the basis of price and performance—a necessary condition in this market—vendors must also compete on the basis of their commitment to the offering, their general company image, and the level of support offered. These are several of the very same factors that the agency respondents rated as important criteria for selection of software.

In the midst of this competitiveness, few vendors tend to dominate in the software segment of large-system procurements. In the software products segment, the market is dominated by mainframe hardware vendors, primarily on the strength of their accompanying systems software. Independent software product suppliers form a distant second-tier group. Similarly, software development revenues from the government are largest for major systems houses that can offer a wide range of professional services. Niche vendors that target specific applications, operating systems, etc. form the second tier.

The market for operational and applications software especially designed for supercomputers is beginning to grow. Software for scientific computations, computational fluid dynamics codes, structural codes, and other performance-type applications are examples of applications software being produced. Communications software packages are also being developed, as well as various operational software packages.

Development and implementation of software for supercomputers is increasingly important as software influences the future design of next generation capabilities and impacts the ease of use and the time required for numerical algorithms. Part of the reason that application software for supercomputers is lagging behind other computer software is the lack of trained staff. This shortage is apparent when it is noted that much of the software development has occurred in the national laboratories, universities, and government sites that only recently acquired supercomputers. Also, it has not been economically feasible for commercial vendors to develop application software, because only customized scientific/engi-

neering applications were being run on supercomputers and not any standard large-scale systems applications. However, companies may start developing innovative software for more-effective use of supercomputers as nonscientific applications become available. Furthermore, a substantial share of the new applications and related software will be derived from the continued efforts of the researchers and corporate pilots at the National Science Foundation supercomputer centers.

The vendor community finds that it is becoming more responsive to the interface requirements of the federal agency users. Exhibit V-8 lists a variety of interconnection methods for linking large systems to mid-size and small systems currently being provided by the industry respondents.

EXHIBIT V-8

INDUSTRY-DEVELOPED INTERFACES OF LARGE SYSTEMS TO MID- AND SMALL-SIZED SYSTEMS

- Local-Area Networks
- TCP/IP Connectivity Tools
- Ethernet
- T1 Lines
- Off-the-Shelf Hardware and Software
- Standard Communication Systems
- FIPS 60 Series

Industry respondents believe that the agency's interface requirements dictate the software environment for large systems. Also, 47% of the respondents noted that they also provide standalone systems that are subject to different requirements.

Vendor respondents were asked to rate the "overall necessity" of providing UNIX-based products for federal large-scale environments in the next few years. On a scale of 1 to 5, where 5 indicated extreme necessity and 1 reflected no necessity at all, their average opinion was 3.6 versus the agencies' rating of 2.6. The higher average rating given by vendors is most likely due to vendors seeing more large-size-systems opportunities from agencies in the long term.

UNIX is also gaining a stronghold as a standard across most of the supercomputer industry vendors. Cray, ETA, and IBM each have taken to UNIX. Also, the Japanese and French supercomputer companies are investing heavily in UNIX. Only those companies with large installed bases to protect will not be as fully involved with UNIX.

In addition to UNIX, there are additional system architectures, standards, and software specifications that the vendors perceive as influencing the hardware and software for large systems they provide to agencies. Exhibit V-9 identifies the features most frequently cited by respondents. These standards and specifications are beginning to direct vendors to accomplish interconnectivity of applications among multiple hardware systems. These are not ranked because vendor respondents did not indicate any pattern of importance.

EXHIBIT V-9

VENDOR VIEWS OF ADDITIONAL FEATURES INFLUENCING SYSTEM ACQUISITIONS

- GOSIP
- Ada
- POSIX
- 3-Tier Architecture
- SQL
- DoD Software Directives
- FIBS PUB 60
- IBM Compatibility

Nearly half (44%) of the vendors surveyed perceive increased competition in the federal large-scale hardware and related services market arising from new start-up companies. Included in the classification of new start-up ventures are entrants from nontraditional companies and companies diversifying into systems integration. One-third of the respondents foresee increased competition arising from foreign companies, many of which are already involved as subcontractors. Only 11% of the

respondents held the view that nonprofit organizations, such as the National Science Foundation, would increase competition in the marketplace. See Exhibit V-10.

EXHIBIT V-10

VENDOR-PERCEIVED SOURCES OF INCREASED COMPETITION

SOURCE	PERCENT RESPONDENTS
New Start-Up Companies	44
Foreign Companies	34
Not-for-Profit Organizations	11
No Increase	11

C

Vendor Selection Criteria

Both the agencies and vendors were queried as to what should be the controlling criteria for the selection of hardware/large system contractors. The vendors' responses, as shown in Exhibit V-11, are similar to the agency responses except that they ranked life cycle cost first, whereas the agencies indicated that the technical solution was first in importance. Industry respondents also noted that the initial cost will become more important due to budgetary constraints.

The majority (85%) of the industry respondents indicated that the government prefers to use fixed-price contracts for large-system hardware acquisitions. The remaining 15% stated that a "mix" of contract vehicles would be employed. Fixed-price contracts were cited as an agency preference by 65% of the government respondents. The industry and agency respondents noted that the fixed-price type contract reflects the government's risk containment and budget control mechanisms and is becoming "standard practice."

Exhibit V-12 presents the industry respondents' ratings for the selection criteria as used by the agencies in their acquisition of large computer system software from vendors. The industry respondents gave a similarly high rating for the three criteria of software features, application functions, and ease of implementation. The agency respondents give the highest rating for application functions. There is apparent agreement throughout the marketplace that the primary selection concern is for the operation of the software and that its performance of specific applications is critical.

EXHIBIT V-11

SELECTION CRITERIA FOR HARDWARE/ LARGE-SYSTEM CONTRACTORS

VENDOR RANK	CRITERIA
1	Life Cycle Cost
2	Technical Solution
3	Risk Containment
4	Initial Cost
5	Contract Type

EXHIBIT V-12

RATINGS FOR SELECTION CRITERIA— LARGE COMPUTER SYSTEM SOFTWARE

SOFTWARE SELECTION CRITERIA	AVERAGE RATING*	
	VENDOR	AGENCY
Software Features	4.3	4.1
Application Functions	4.3	4.4
Ease of Implementation	4.3	3.7
Support Reputation	3.7	4.1
Product Price	3.4	3.5
Federal Experience	2.7	2.9

*Rating: 1 = Not Important; 5 = Very Important.

D

Teaming Patterns

Vendors viewed their teaming relationships with other vendors more successfully than their client agencies did. They rated their overall teaming success a 3.7 versus the agency rating of 2.9. A 1 to 5 scale was used by both vendors and agencies to evaluate past teaming relationships: 5 meant extremely successful; 1 meant not successful at all.

The vendors also had similar suggestions on how to improve their teaming relationships with other vendors as those made by the agencies earlier in Exhibit IV-23. Comments made by the vendors are summarized in Exhibit V-13. The industry recognizes the same need for more cooperation and communication with its teaming partners. However, the vendors suggested less reliance on the prime contractors while the agencies suggested greater enforcement of the prime's responsibilities. Lastly, although asked if teaming would be negatively impacted or improved by forming alliances with other types of vendors (i.e., FM, SI, etc.), vendors were reluctant to identify any vendors which they may consider as future teaming partners.

EXHIBIT V-13

VENDOR SUGGESTIONS FOR IMPROVED TEAMING RELATIONSHIPS

- Coordinate Marketing More Closely with Subcontractors
- Clearly Define Roles Early in Project
- Obtain Better Knowledge of Team Members' Expertise
- Obtain Strong Committments from All Parties
- Rely Less on Prime Contractors

Using the recent Department of Transportation's $3.5 billion award to IBM for the FAA's Advanced Automation System (AAS) as an example of a large system, the teaming for AAS shows how large systems draw upon the specific skills of each vendor and designates explicit functions to which they are most suited to handle. The Advanced Automated System project will provide a fully integrated system that will replace the outdated system and allow for increases in air traffic, along with enhanc-

ing the safety of air travel. The competing bidding teams were led by IBM and Hughes Aircraft.

The winning team, led by IBM's Systems Integration Division, also consists of Computer Sciences Corp. and the Raytheon Company. IBM is already supplying the host computer system and will be providing the communications, software, and hardware for AAS along with managing the project. CSC will provide software development and systems engineering support, while Raytheon will replace FAA radar displays with new model consoles they will manufacture. The contract may extend to 15 years and ultimately be valued at $10 billion.

E
Vendor Performance

1. Satisfaction Level

Vendors were asked their opinion of the level of satisfaction of government agencies with the past performance of large-scale system contractors. The results are presented in Exhibit V-14. The agency responses are shown for comparison.

Vendors believe the federal government is reasonably satisfied with both the hardware and software offered by industry. By comparison, the federal agency respondents gave a similar rating for software offerings, but a higher level of satisfaction for the hardware offered. The agencies also rated delivery schedule performance price and staff experience higher than the vendors. In most other functions, the vendors and agencies gave similar ratings.

2. Suggested Improvements to Products and Services

The industry respondents were asked what they believe vendors need to do over the next five years to make their products and services more valuable to the federal government. The replies varied due to the different types and levels of experience the vendors have encountered with the federal agencies.

In descending order of frequency of mention, Exhibit V-15 lists the principal suggestions made by the respondents. Improved adaptation of standards was cited most frequently as a suggested means of making vendor services more valuable. Since this improvement was a major concern voiced by agencies, it appears to be a positive step in enhancing satisfaction levels.

EXHIBIT V-14

VENDOR RATING OF IMPORTANT VENDOR PERFORMANCE CHARACTERISTICS

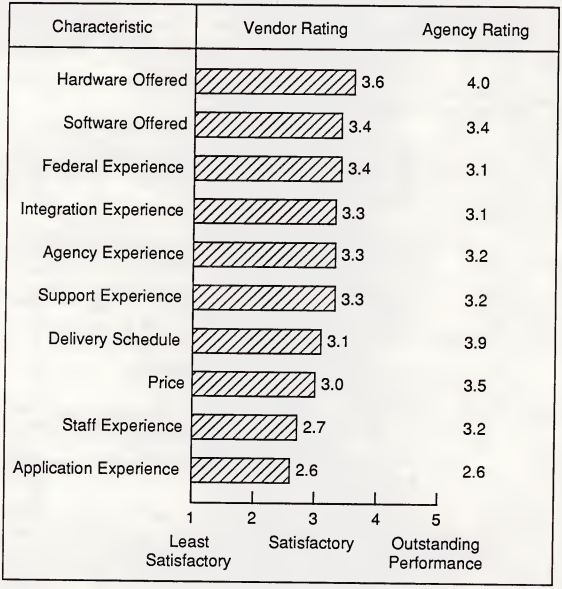


EXHIBIT V-15

SUGGESTED IMPROVEMENTS TO PRODUCTS AND SERVICES

SUGGESTION	RANK*
Improvement in Adaptation of Standards	1
Improvement in Compatibility and Interoperability of Systems	2
Improvement in Reliability of Products	3
Providing Better Product Support	4
Improvement in Management and Reporting Capabilities	5

*Rank based on frequency of mention by respondents.

F

Trends

The industry respondents were asked their opinions on how each of several government policies or programs will impact the federal agencies' large-scale systems acquisitions through FY 1993. Budgetary constraints were viewed by the vendors as having the most significant impact. The comments are summarized in Exhibit V-16.

Other notable factors mentioned during the interviews were the political aftermaths of the procurement fraud investigations and the DoD spending moratorium. Agencies may require more burdensome paperwork on behalf of vendors to keep the procurement "open and honest." In addition, more oversight of the budget spending and monitoring of the federal purse strings is foreseeable. Greater priority will go to mission critical systems, whereas other procurements for large systems will suffer further delays or are cancelled.

There are additional industry factors that will affect revenues in the federal market for large systems and acquisitions of supercomputers. These include:

- Merger and acquisition of firms
- Industry standardization efforts
- Increased competition from foreign companies

EXHIBIT V-16

VENDOR COMMENTS ON IMPACT OF GOVERNMENT POLICIES AND PROGRAMS

FIRMR

- Require Compliance
- Contribute Minor Impact
- Anticipate Future Changes

CICA

- Increased Number of Protests
- Require Longer Term Procurements
- Increased Competition
- Lowered Software Prices
- Provides an Enforcement Function

Trail Boss Program

- Consolidated Contact to One Individual for Decisions
- Provides More Focus on Procurement Management
- Viewed as Too Early to Judge Any Benefits
- Requires Program to Be Taken More Seriously

Budget Constraints

- Lessened Opportunities
- Caused Delays in Procurements
- Reduced Funding for DoD ADP Programs
- Reduced Funding for More Systems
- Viewed as Costly to Vendors
- Attributes to Industry Shake-Outs

A significant influence arises from the continuing mergers and acquisitions throughout the industry. The expansion of resources within the larger restructured firm allows for reorganization into a stronger competitor. The standardization efforts will strongly impact the industry's development of products as well as increase the compatibility and interoperability requirements of large systems. To the extent that standards aid the vendors' ability to be responsive to agency needs, these measures will be well-received in the federal market. Loss of account control by the use of a vendor's unique features could seriously impact vendor revenues.

Increased competition from foreign companies may develop into a major force shaping future revenues. Currently several Japanese companies are subcontractors to systems integrators and other companies are marketing supercomputers that compete directly in price and performance with the already established American firms. The role of foreign companies in this market is still evolving and it remains to be determined what "niches" the foreign competitors will direct their efforts.

Industry representatives were also asked to identify those technological factors that would alter the federal government's spending for large-scale systems. The factors named most frequently are listed in Exhibit V-17.

EXHIBIT V-17

TECHNICAL TRENDS THAT IMPACT FUTURE SYSTEMS ACQUISITIONS

FACTOR	RANK*
Developments in Optical Disk Storage	1
Increased Emphasis on Development of Expert Systems and Artificial Intelligence	2
Microcomputer Revolution or Expansion	3
Increased Efforts toward Software Compatibility	4
Developments in Fiber Optics	5

*Rank based on frequency of mention by respondents.

The increase in optical disk storage system capabilities was most frequently cited by the vendors as having a strong impact on future large-system acquisitions. Agencies are already seeking to procure these optical disk storage systems as they attempt to upgrade their major information memory systems.

Artificial intelligence is gaining in usage in tactical situations, automated planning, and support applications throughout DoD. Large-scale information processing is the principle area of applications for AI as it is developing in the civilian agencies.

Vendors cited the increase in microcomputer products and more powerful microcomputers as significant to the future development of the large-systems and systems integration market. Use of microcomputers will emphasize software transportability. Also, with the aid of economical LANs (Local-Area Networks), the density of PCs will accelerate implementation and use of distributed processing.

Technological developments in secured communications transmission media were also noted as an important factor by vendors. The technological advancements in hardware, and especially in supercomputers, were noted by a small percent of respondents.

The government's unique requirements are pushing advancements in technology. Technological efforts toward achieving greater interconnectivity and compatibility of networking processes will accelerate into the early 1990s. Interconnectivity of systems will be emphasized for rapid data transfer. There will be further development of transparent networks and/or standard protocols such as OSINET (Open Systems Interconnect Network) and MAP/TOP (Manufacturing Automation Protocols/Technical and Office Protocols).

The supercomputer market is also faced with several yet unresolved technical issues that slightly impede usage of the high-powered computers. The user community concerns that focus on software are shown in Exhibit V-18. These areas reflect the relatively short period in which supercomputers have been in use compared to other computers and also the complexity of the machines.

At present, research efforts are also being conducted to develop new operating systems for parallel architectures. One project is entitled MACH and is located at the Carnegie-Mellon University in Pittsburgh. The project is gaining popularity with several vendors and additional languages and applications will eventually be designed to accompany the resulting operating systems for parallel architectures.

EXHIBIT V-18

AREAS OF TECHNICAL CONCERNS FOR SUPERCOMPUTER USERS

- Increased Variety of Software
- Improved Algorithms
- Greater Avaialbility of Compilers and Editors
- Further Development of High-Level Programming Languages
- Increased User Training for FORTRAN Language

In May 1988, under its technology transfer program, the Los Alamos National Laboratory (DoE) signed an agreement with IBM Corp. IBM's efforts are to produce a scientific/lab-oriented commercial supercomputer. As a start, IBM is installing a two-processor IBM 3090-200E computer that will be integrated into the lab's network for research and prototyping.

Los Alamos is also coordinating efforts with several vendors in its development of a distributed supercomputer environment. An agreement is in place with Digital Equipment Corp. for the design of high-speed network products. The Los Alamos Laboratory's long-term goal is to build a high-speed distributed network that will link advanced workstations equipped with supercomputer capabilities.

Key Opportunities

This section describes specific opportunities in the federal information technology market. Lists of programs are provided for future large-scale systems acquisitions. The opportunities list consists of major programs that are typical of the federal market and serves as a representative sample.

The list of opportunities becomes smaller after fiscal year 1989 because new programs have not yet been identified or initially approved by the responsible agencies. Subsequent issues of this report and the INPUT Procurement Analysis Reports will include additional programs and detailed information for fiscal years 1989 through 1993.

A

Present and Future Programs

New information technology programs larger than $1 million - $2 million are listed in at least one of the following federal government documents:

- OMB/GSA Five-Year Plan, which is developed from agency budget requests submitted in compliance with OMB Circular A-11
- Agency long-range information resource plans developed to meet the reporting requirements of the Paperwork Reduction Act of 1980
- Agency annual operating budget requests submitted to both congressional oversight and appropriations committees based on the OMB A-11 information
- *Commerce Business Daily* for specific opportunities, for qualifications as a bidder, and to obtain a copy of an RFP or RFQ
- Five-Year Defense Plan, which is not publicly available, and the supporting documentation of the separate military departments and agencies

- Classified program documentation available to qualified DoD contractors

Turnkey systems and systems integration opportunities may not be specifically identified as such in these documents. Information technology planning documents usually identify mission requirements to be met by specific programs rather than methods for meeting these requirements. Some mission requirements could be satisfied equally well by either custom system development or by turnkey system acquisition. An agency decision to use a systems integration contractor may not be made until a program is well underway and an acquisition plan has been formulated. Over the last several years, however, agencies have shown an increasing tendency to use systems engineering and integration contractors for larger, more-complex systems.

All funding proposals are based on cost data of the year submitted with inflation factors dictated by the Administration as part of its fiscal policy, and are subject to revision, reduction, or spread to future years in response to congressional direction. Some additional reductions may be likely in FY 89 and beyond due to the deficit reduction constraints of the Gramm-Rudman-Hollings Act and other budgetary constraints.

B

Large-Scale Systems Opportunities by Agency

Agency/Program	PAR Reference	RFP Schedule	FY 88-FY93 Funding (Est. $ M)
Air Force			
Air Force WWMCCS Information System (AFWIS)	V-1-27	1QFY90	-
Command Readiness Exercise System (CRES) Phase III	V-1-34	2QFY89	$19.9
Air Force Technical Order Management System (AFTOMS)	V-1-53	3QFY90	$29.0
Joint Mission Processor (JMP)	V-1-103	1QFY90	TBD
Contracting Data Management System—Phase II (CDMS)	V-1-104	1QFY90	$52.2
Army			
Army WWMCCS Information System (AWIS)	V-2-8	1QFY90	-
Standard Depot Systems (SDS)	V-2-28	2QFY89	$10.2
Navy			
PERSPAY Consolidated Computer Center Program	V-3-11	2QFY91	$79.2
Primary Environmental Processing System Replacement (PEPSR)	V-3-22	Multiple RFPs	$14.7
Scientific and Engineering Computer System	V-3-92	3QFY89	$5.0
Department of Agriculture			
Farmers Home Administration/ Automated Administrative Management System (AAMS)	VI-5-24	-	$5.1
Forest Service/Forest Level Information Processing System (FLIPS)	VI-5-30	2QFY91	$113.9

Agency/Program	PAR Reference	RFP Schedule	FY 88-FY93 Funding (Est. $ M)
Department of Commerce			
National Weather Service/Advanced Weather Interactive Processing System (AWIPS)	VI-6-24	2QFY89	$143.2
NIST/Central Computing Facility	VI-6-26	-	$58.2
National Weather Service/Enhancement of the Office of Systems Operations (OSO) Gateway Computer Systems	VI-6-30	-	$8.3
Department of Energy			
National Magnetic Fusion Energy Computer Center/Class VII Computer	VI-7-16	-	$24.0
Lawrence Livermore National Laboratory/Class VII Computer System	VI-7-22	-	$24.1
Los Alamos National Laboratory/ Class VII Computers	VI-7-37	-	$54.3
Defense Programs Office/ Enhanced Class VII Computers	VI-7-48	-	$49.0
Sandia National Laboratories/ Class VII Computer	VI-7-79	2QFY89	$30.2
Department of Health and Human Services			
HCFA/Medicare Catastrophic Protection Network	VII-8-38	4QFY89	-
Department of the Interior			
BLM/ADP Equipment Modernization Project	VII-9-8	3QFY89	$30.4
BLM/Automated Land and Mineral Record System (ALMRS)	VII-9-11	3QFY89	$146.5

Agency/Program	PAR Reference	RFP Schedule	FY 88-FY93 Funding (Est. $ M)
Department of Labor			
PWBA/ERISA Electronic Data Base	VII-9A-2	1QFY89	$57.1
Department of State			
Information Systems Office/ Co-Processing Facility	VII-9C-2	-	$55.3
Department of Justice			
Justice Telecommunications Network (JTN)	VII-10-11	1QFY89	$81.2
Justice Computer Center/Upgrade of Washington D.C. Justice Computer Center	VII-10-22	1QFY89	$148.9
U.S. Marshalls Service/National Prisoner Transportation System	VII-10-23	FY89	-
Department of Transportation			
FAA/Computer Resources Nucleus (CORN)	VII-11-28	1QFY89	$1,000
U.S. Coast Guard/Marine Safety Information System II (MSIS II)	VII-11-32	1QFY91	-
Department of the Treasury			
IRS/Tax System Redesign	VII-12-6	3QFY89	$1,000
Financial Management Service/ System 90	VII-12-46	1QFY89	$37.6
U.S. Customs Service/Automated Commercial System	VII-12-51	-	$257.4
General Services Administration			
IRMS/Information Processing and Data Communications for the 1990s	VIII-14-5	Draft RFP 1QFY89	$66.7

Agency/Program	PAR Reference	RFP Schedule	FY 88-FY93 Funding (Est. $ M)
NASA			
Goddard Space Flight Center/ UNIVAC 1100s Replacement	VIII-15-36	1QFY89	-
Lewis Research Center/Class VII Computer System	VIII-15-57	1QFY89	$20.0
Ames Research Center/ Numerical Aerodynamics Simulator (NAS) Processing System Network (NPSN)	VIII-15-60	FY90	$80.9
Marshall Space Flight Center/ Engineering Analysis and Data System (EADS)	VIII-15-71	4QFY89	$72.0
Veterans Administration			
Department of Veterans Benefit/ DVB Modernization	VIII-16-11	FY1991	$121.9
Office of Information Systems and Telecommunications/Austin Equipment Replacement	VIII-16-13	2QFY89	$46.1
Department of Medicine and Surgery/ Integrated Supply Management System (ISMS)	VIII-16-14	2QFY89	$12.7
Agency for International Development			
Upgrading Computer Services for Central Computing Center	VIII-26-1	FY92	$3.2

Interview Profiles

Appendix: Interview Profiles

A

Federal Agency Respondent Profile

1. Contact Summary

Contacts with agencies were made by telephone, mail, and through on-site visits. On-site interviews were conducted primarily at the department level with officials in the office of Information Resources Management who are responsible for office systems policy and planning.

The distribution of job classifications among individual agency respondents for the analysis is as follows:

	Policy	Buyers	Users	Total
Respondents	8	4	5	17

2. List of Agencies Interviewed

Respondents interviewed represented the agencies listed below, with the number in parentheses indicating the number of different contacts within the agency.

- Department of Defense
  - Air Force
  - Army
  - Defense Logistics Agency (2)
  - Navy (2)
- Civilian Agencies
  - Department of Agriculture
  - Department of Commerce

- Department of Energy
- General Services Administration
- Department of Health and Human Services
- Department of Labor
- National Aeronautics and Space Administration
- Department of Treasury (2)
- Veterans Administration

B

Vendor Respondent Profile

For this 1988 study, INPUT contacted a representative sample of vendors that provide large-scale systems to the federal government.

Job classifications among individual vendor respondents included marketing, technical, and administrative executives.

Contacts with vendor personnel were made by telephone and by mail.

Definitions

Appendix: Definitions

The definitions in this appendix include hardware, software, services, and telecommunications categories to accommodate the range of information systems and services programs described in this report.

Alternate service mode terminology employed by the federal government in its procurement process is defined along with INPUT's regular terms of reference, as shown in Exhibit B-1.

The federal government's unique nontechnical terminology that is associated with applications, documentation, budgets, authorization, and the procurement/acquisition process is included in Appendix C, Glossary of Federal Acronyms.

A

Delivery Modes

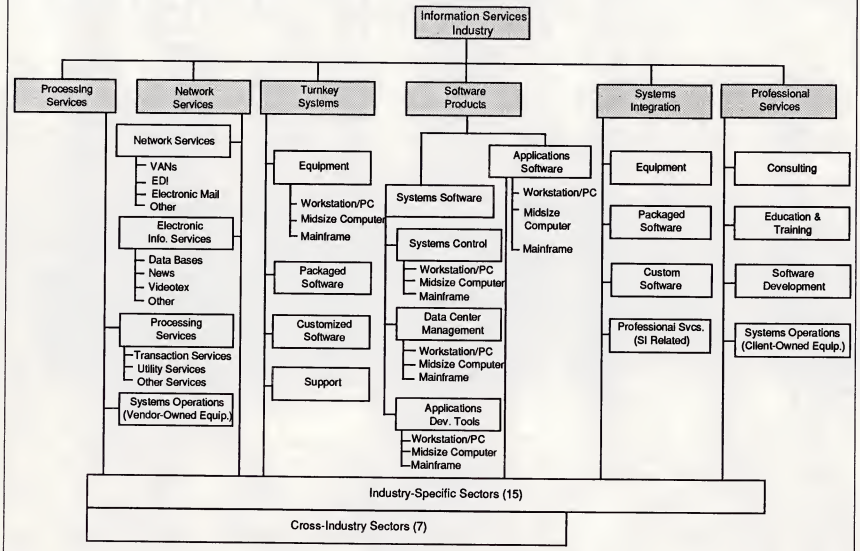
Processing services - This category includes transaction processing, utility processing, other processing services, and processing facilities management.

- *Transaction Processing Services* - Updates client-owned data files by entry of specific business activity, such as sales order, inventory receipt, cash disbursement, etc. Transactions may be entered in one of three modes.

  - *Interactive* - Characterized by the interaction of the user with the system, primarily for problem-solving timesharing, but also for data entry and transaction processing; the user is on-line to the program files. Computer response is usually measured in seconds or fractions of a second.

  - *Remote Batch* - Where the user hands over control of a job to the vendor's computer, which schedules job execution according to priorities and resource requirements. Computer response is measured in minutes or hours.

FEDERAL INFORMATION SYSTEMS AND SERVICES PROGRAM
INFORMATION SERVICES INDUSTRY STRUCTURE
1988



- *User Site Hardware Services (USHS)* - Those offerings provided by processing services vendors that place programmable hardware at the user's site rather than at the vendor's data center. Some vendors in the federal government market provide this service under the label of distributed data services. USHS offers:

  * Access to a communications network.

  * Access through the network to the RCS vendor's larger computers.

  * Local management and storage of a data base subset that will service local terminal users via the connection of a data base processor to the network.

  * Significant software as part of the service.

- *Utility Processing* - Vendor provides access to basic software tools enabling the users to develop their own problem solutions such as language compilers assemblers, DBMS, sorts scientific library routines, and other systems software.

"Other" Processing Services include:

- *Batch Services* - These include data processing at vendors' sites for user programs and/or data that are physically transported (as opposed to transported electronically by telecommunications media) to and/or from those sites. Data entry and data output services, such as keypunching and computer output microfilm processing, are also included. Batch services include expenditures by users who take their data to a vendor site that has a terminal connected to a remote computer for the actual processing. Other services also includes disaster recovery and backup services.

- *Systems Operations (Processing)* - Also referred to as "Resource Management," Facilities Management or "COCO" (contractor-owned, contractor-operated). Systems control is the management of all or part of a user's data processing functions under a long-term contract of not less than one year. This would include remote computing and batch services. To qualify, the contractor must directly plan, control, operate, and own the facility provided to the user–either onsite, through communications lines, or in a mixed mode.

Processing services are further differentiated as follows:

- *Cross-industry* services involve the processing of applications that are targeted to specific user departments (e.g., finance, personnel, sales) but that cut across industry lines. Most general-ledger, accounts receivable, payroll, and personnel applications fall into this category.

Cross-industry data base services, for which the vendor supplies the data base and controls access to it (although it may be owned by a third party), are included in this category. General-purpose tools such as financial planning systems, linear regression packages, and other statistical routines are also included. However, when the application, tool, or data base is designed for specific industry use, then the service is industry-specific (see below).

- *Industry-specific* services provide processing for particular functions or problems unique to an industry or industry group. Specialty applications can be either business or scientific in orientation. Industry-specific data base services, for which the vendor supplies the data base and controls access to it (although it may be owned by a third party), are also included under this category. Examples of industry-specialty applications are seismic data processing, numerically controlled machine tool software development, and demand deposit accounting.

Network Services include a wide variety of network-based function and operations. The common thread is that more of these functions could be performed without network involvement. Network services is divided into several segments: value-added networks (enhanced services), and network applications (electronic information systems).

- *Value-Added Networks (VANs)* - VANs typically involve common carrier network transmission facilities that are augmented with computerized switched. These networks have become associated with packet-switching technology because the public VANs that have received the most attention (e.g., Telenet and TYMNET)employ packet-switching techniques. However, other added data service features such as store-and-forward message switching, terminal interfacing, error detection and correction, and host computer interfacing are of equal importance.

- Network applications include Electronic Data Interchange (EDI) the application-to-application electronic communications between organizations, based on established business document standards, and electronic mail.

Software products - This category includes user purchases of applications and systems software packages for in-house computer systems. Included are lease and purchase expenditures, as well as expenditures for work performed by the vendor to implement or maintain the package at the user's sites. Expenditures for work performed by organizations other than the package vendor are counted in the category of professional services. Fees for work related to education, consulting, and/or custom modification of software products are counted as professional services, provided such fees are charged separately from the price of the software product itself. There are several subcategories of software products, as indicated below and shown in detail in Exhibit B-2.

EXHIBIT B-2

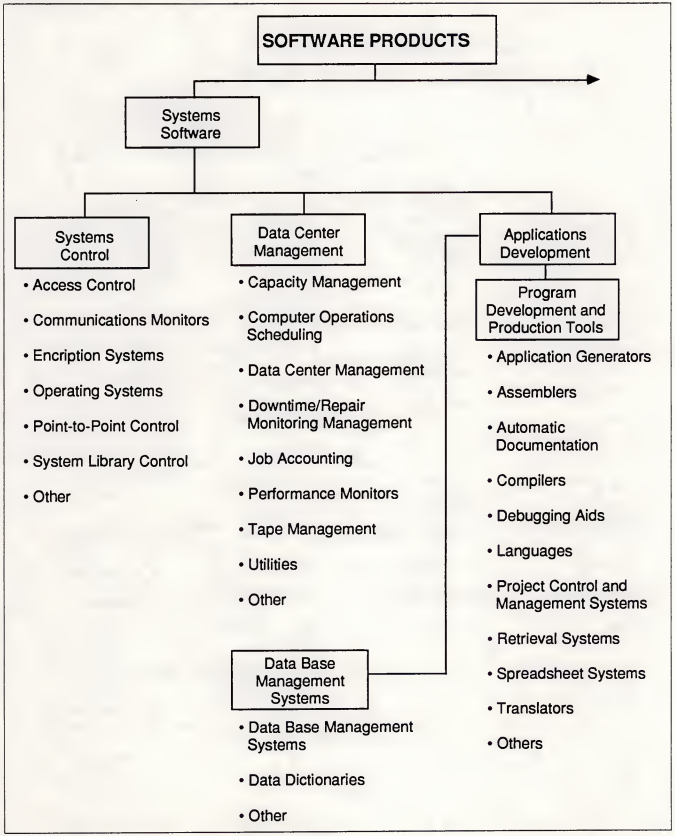
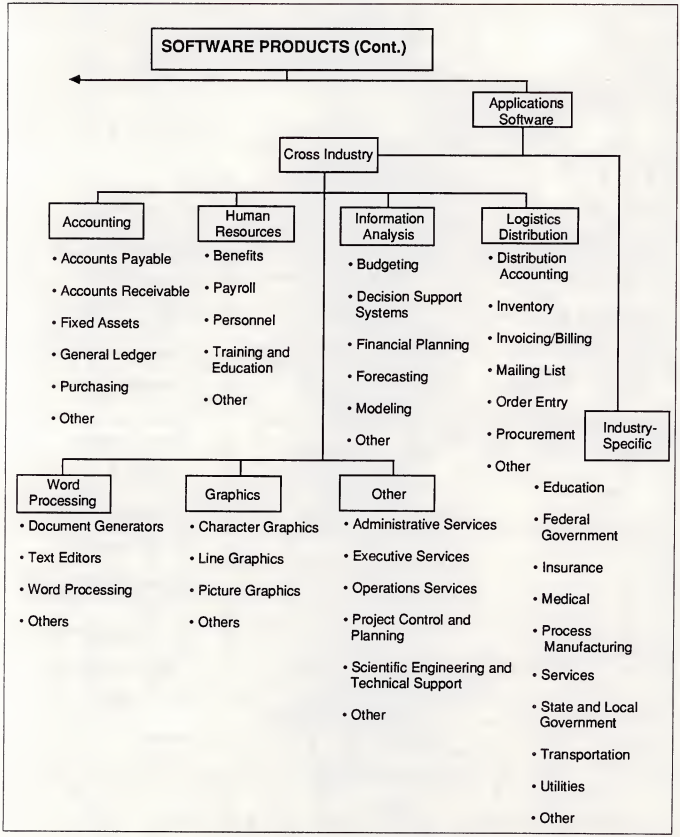


EXHIBIT B-2 (Cont.)



- *Applications Products* - Software that performs functions directly related to solving user's business or organizational need. The products can be:
  - *Cross-Industry Products* - Used in multiple-industry applications as well as the federal government sector. Examples are payroll, inventory control, and financial planning.
  - *Industry-Specific Products* - Used in a specific industry sector, such as banking and finance, transportation, or discrete manufacturing. Examples are demand deposit accounting, airline scheduling, and material resource planning.
- *Systems Software Products* - Software that enables the computer/communications system to perform basic functions. These products include:
  - *System Control Products* - Function during applications program execution to manage the computer system resources. Examples include operating systems, communication monitors, emulators, spoolers, network control, library control, windowing, access control.
  - *Data Center Management Products* - Used by operations personnel to manage the computer systems resources and personnel more effectively. Examples include performance measurement, job accounting, computer operations scheduling, utilities, capacity management.
  - *Applications Development Products* - Used to prepare applications for execution by assisting in designing, programming, testing, and related functions. Examples include traditional programming languages 4GLs, sorts, productivity aids, assemblers, compilers, data dictionaries, data base management systems, report writers, project control and CASE systems.

Professional Services - This category includes consulting, education and training, software development, and systems operations as defined below.

- *Software development* - Develops a software system on a custom basis. It includes one or more of the following: user requirements definition, system design, contract, programming, documentation.
- *Education and Training* - Products and/or services related to information systems and services for the user, including computer-aided instruction (CAI), computer-based education (CBE), and vendor instruction of user personnel in operations, programming, and maintenance.

- *Consulting Services* - Information systems and/or services management consulting, project assistance (technical and/or management), feasibility analyses, and cost-effectiveness trade-off studies.

- *Systems Operations (Professional Services)* - This is a counterpart to systems operations (professional services) except the computing equipment is owned or leased by the client, not by the vendor. The vendor provides the staff to operate, maintain, and manage the client's facility.

Turnkey Systems - A turnkey system is an integration of systems and applications software with CPU hardware and peripherals, packaged as a single application (or set of applications) solution. The value added by the vendor is primarily in the software and support. Most CAD/CAM systems and many small-business systems are turnkey systems. This does not include specialized hardware systems such as word processors, cash registers, or process control systems, nor does it include Embedded Computer Resources for military applications. Turnkey systems may be either custom or packaged systems.

- Hardware vendors that combine software with their own general-purpose hardware are not classified by INPUT as turnkey vendors. Their software revenues are included the appropriate software category.

- Turnkey systems revenue is divided into two categories.

  - *Industry-specific systems* - that is, systems that serve a specific function for a given industry sector such as automobile dealer parts inventory, CAD/CAM systems, or discrete manufacturing control systems.

  - *Cross-industry systems* - that is, systems that provide a specific function that is applicable to a wide range of industry sectors such as financial planning systems, payroll systems, or personnel management systems.

- Revenue includes hardware, software, and support functions.

Systems Integration: (SI) delivery of large, complex multi-disciplinary, multi-vendor systems, incorporating some or all of these categories: systems design, programming, integration, equipment, packaged software, communication networks, installation education and training, and SI related professional services and acceptance. Systems integration contracts typically take more than a year to complete and involve a prime contractor assuming risk and accepting full responsibiltiy.

B

Hardware/Hardware Systems

Hardware - Includes all computer and telecommunications equipment that can be separately acquired with or without installation by the vendor and not acquired as part of an integrated system.

- *Peripherals* - Includes all input, output, communications, and storage devices (other than main memory) that can be connected locally to the main processor, and generally cannot be included in other categories such as terminals.

- *Input Devices* - Includes keyboards, numeric pads, card readers, light pens and track balls, tape readers, position and motion sensors, and analog-to-digital converters.

- *Output Devices* - Includes printers, CRTs, projection television screens, micrographics processors, digital graphics, and plotters.

- *Communication Devices* - Includes modems, encryption equipment, special interfaces, and error control.

- *Storage Devices* - Includes magnetic tape (reel, cartridge, and cassette), floppy and hard disks, solid state (integrated circuits), and bubble and optical memories.

Terminals - Three types of terminals are described below:

- *User-Programmable* - Also called intelligent terminals, including:

  - Single-station or standalone.
  - Multistation shared processor.
  - Teleprinter.
  - Remote batch.

- *User Nonprogrammable*

  - Single-station.
  - Multistation shared processor.
  - Teleprinter.

- *Limited Function* - Originally developed for specific needs, such as point-of-sale (POS), inventory data collection, controlled access, and other applications.

Hardware Systems - Includes all processors from microcomputers to supercomputers. Hardware systems may require type- or model-unique operating software to be functional, but this category excludes applica-

tions software and peripheral devices, other than main memory and processors or CPUs not provided as part of an integrated (turnkey) system.

- *Microcomputer* - Combines all of the CPU, memory, and peripheral functions of an 8-, 16-, or 32-bit computer on a chip in the form of:
  - Integrated circuit package.
  - Plug-in boards with more memory and peripheral circuits.
  - Console including keyboard and interfacing connectors.
  - Personal computer with at least one external storage device directly addressable by the CPU.
  - An embedded computer which may take a number of shapes or configurations.
- *Midsize Computer* - Typically a 32- or 64-bit computer with extensive applications software and a number of peripherals in standalone or multiple-CPU configurations for business (administrative, personnel, and logistics) applications; also called a general purpose computer. All Intel 80386, Motorola 68000-based systems, and large multi-user systems are included. Specific systems in this category are: IBM 93XX systems, all Digital VAX series systems, and such common UNIX-based systems as from Apollo and Sun) are also included. Most large shared logic, integrated office systems, such as those form Wang, Hewlett-Packard and Honeywell Bull would also be considered mid-size systems. Does not include microcomputers (standalone, or shared), embedded systems and CAD/CAM systems.
- *Large Computer* - Presently centered around storage controllers but likely to become bus-oriented and to consist of multiple processors or parallel processors. Intended for structured mathematical and signal processing and typically used with general purpose, VonNeumann-type processors for system control. Usually refers to traditional mainframes (such as IBM 30XX, UNISYS (Sperry) 1100/XX, Honeywell DDPS88, UNISYS (Burroughs) A15, or CDC Cyber series) and supercomputers (such as products from Cray, ETA, Fujitsu, and the new IBM development effort).
- *Supercomputer* - High-powered processors with numerical processing throughput that is significantly greater than the fastest general purpose computers, with capacities in the 100-500 million floating point operations per second (MFLOPS) range. Newer supercomputers, with burst modes over 500 MFLOPS, main storage size up to 10 million words, and on-line storage in the one-to-three gigabyte class, are labeled Class

IV to Class VII in agency long-range plans. Supercomputers fit in one of two categories:

- *Real Time* - Generally used for signal processing in military applications.
- *Non-Real Time* - For scientific use in one of three configurations:
  - Parallel processors.
  - Pipeline processor.
  - Vector processor.
- *Super( )computer* - Term applied to micro, mini, and large mainframe computers with performance substantially higher than attainable by VonNeuman architectures.

- *Embedded Computer* - Dedicated computer system designed and implemented as an integral part of a weapon, weapon system, or platform; critical to a military or intelligence mission such as command and control, cryptological activities, or intelligence activities. Characterized by military specifications (MIL SPEC) appearance and operation, limited but reprogrammable applications software, and permanent or semi-permanent interfaces. May vary in capacity from microcomputers to parallel processors computer systems.

C

Telecommunications

Networks - Electronic interconnection between sites or locations that may incorporate links between central computer sites and remote locations and switching and/or regional data processing nodes. Network services typically are provided on a leased basis by a vendor to move data, voice, video, or textual information between locations. Networks can be categorized in several different ways.

- *Common Carrier Network* - A public access network, such as provided by AT&T, consisting of conventional voice-grade circuits and regular switching facilities accessed through dial-up calling with leased or user-owned modems for transfer rates between 150 and 1200 baud.
- *Value-Added Network (VAN)* - (See listing under Section B, Delivery Modes.)
- *Local Area Network (LAN)* - Limited-access network between computing resources in a relatively small (but not necessarily contiguous) area, such as a building, complex of buildings, or buildings distributed within a metropolitan area. Uses one of two signaling methods.
  - *Baseband* - Signaling using digital waveforms on a single frequency band, usually at voice frequencies and bandwidth, and limited to a

single sender at any given moment. When used for local-area networks, typically implemented with TDM to permit multiple access.

- *Broadband* - Transmission facilities that use frequencies greater than normal voice-grade, supported in local-area networks with RF modems and AC signaling. Also known as wideband. Employs multiplexing techniques that increase carrier frequency between terminals to provide:

  - Multiple (simultaneous) channels via FDM (Frequency Division Multiplexing).

  - Multiple (time-sequenced) channels via TDM (Time Division Multiplexing).

  - High-speed data transfer rate via parallel mode at rates of up to 96,000 baud (or higher, depending on media).

- *Wide Area Network (WAN)* - Limited access network between computing resources in buildings, complexes of buildings, or buildings within a large metropolitan or wide geographical area. Uses either baseband or broadband signaling methods.

Transmission Facilities - Includes wire, carrier, coaxial cable, microwave, optical fiber, satellites, cellular radio, and marine cable operating in one of two modes depending on the vendor and the distribution of the network.

- *Mode* - may be either:

  - *Analog* - Transmission or signal with continuous-waveform representation, typified by AT&T's predominantly voice-grade DDD network and most telephone operating company distribution systems.

  - *Digital* - Transmission or signal using discontinuous, discrete quantities to represent data, which may be voice, data, record, video, or text, in binary form.

- *Media*- May be any of the following:

  - *Wire* - Varies from earlier single-line teletype networks, to two-wire standard telephone (twisted pair), to four-wire full- duplex balanced lines.

  - *Carrier* - A wave, pulse train, or other signal suitable for modulation by an information-bearing signal to be transmitted over a communications system, used in multiplexing applications to increase network capacity.

- *Coaxial Cable* - A cable used in HF (high-frequency) and VHF (very high frequency), single-frequency, or carrier-based systems; requires frequent reamplification (repeaters) to carry the signal any distance.

- *Microwave* - UHF (ultra-high-frequency) multichannel, point-to-point, repeated radio transmission, also capable of wide frequency channels.

- *Optical Fiber* - Local signal distribution systems employed in limited areas, using light-transmitting glass fibers and TDM for multichannel applications.

- *Communications Satellites* - Synchronous earth-orbiting systems that provide point-to-point, two-way service over significant distances without intermediate amplification (repeaters), but requiring suitable groundstation facilities for up- and down-link operation.

- *Cellular Radio* - Network of fixed, low-powered two-way radios that are linked by a computer system to track mobile phone/data set units. Each radio serves a small area called a cell. The computer switches

D

General Definitions

103/113 - Bell standard modem for low-speed transmission up to 300 bps, asynchronous, half or full duplex.

212 - Bell standard for medium-speed transmission at 1200 bps, asynchronous or synchronous, half or full duplex.

ASCII - American National Standard Code for Information Interchang— eight-bit code with seven data bits and one parity bit.

Asynchronous - Communications operation (such as transmission) without continuous timing signals. Synchronization is accomplished by appending signal elements to the data.

Bandwidth - Range of transmission frequencies that can be carried on a communications path; used as a measure of capacity.

Baud - Number of signal events (discrete conditions) per second. Typically used to measure modem or terminal transmission speed.

Benchmark - Method of testing proposed ADP system solutions for a specified set of functions (applications) employing simulated or real data inputs under simulated operating conditions.

BPS - Bits per second - also mbps and kbps, million bits per second and thousand bits per second, respectively.

BSC - IBM's binary synchronous communications data link protocol. First introduced in 1968 for use on point-to-point and multipoint communications channels. Frequently referenced as "bisync."

Byte - Usually equivalent to the storage required for one alphanumeric character (i.e., one letter or number).

CBX - Computerized Branch Exchange - a PABX based on a computer system, implying programmability and usually voice and data capabilities.

Central Processing Unit (CPU) - The arithmetic and control portion of a computer; i.e., the circuits controlling the interpretation and execution of computer instructions.

Centrex - Central office telephone services that permit local circuit switching without installation of customer premises equipment. Could be described as shared PBX service.

Circuit Switching - A process that, usually on demand, connects two or more network stations and permits exclusive circuit use until the connection is released; typical of the voice telephone network where a circuit is established between the caller and the called party.

CO - Central Office - local telco site for one or more exchanges.

CODEC - Coder/decoder, equivalent to modem for digital devices.

Constant Dollars - Growth forecasts in constant dollars make no allowance for inflation or recession. Dollar value based on the year of the forecast unless otherwise indicated.

Computer System - The combination of computing resources required to perform the designed functions and which may include one or more CPUs, machine room peripherals, storage systems, and/or applications software.

CPE - Customer Premises Equipment - DCE or DTE located at a customer site rather than at a carrier site such as the local telephone company CO. May include switchboards, PBX, data terminals, and telephone answering devices.

CSMA/CD - Carrier Sense Multiple Access/Collision Detect. Contention protocol used in local-area networks, typically with a multi-point configuration.

Current Dollars - Estimates or values expressed in current-year dollars which, for forecasts, would include an allowance for inflation.

Data Encryption Standard (DES) - 56-bit key, one-way encryption algorithm adopted by NBS in 1977, implemented through hardware ("S-boxes") or software. Designed by IBM with NSA guidance.

Datagram - A self-contained packet of information with a finite length that does not depend on the contents of preceding or following packets.

DCA - IBM's Document Content Architecture - protocols for specifying document (text) format which are consistent across a variety of hardware and software systems within IBM's DISOSS.

DCE - Data Circuit-terminating Equipment - interface hardware that couples DTE to a transmission circuit or channel by providing functions to establish, maintain, and terminate a connection, including signal conversion and coding.

DDCMP - Digital Data Communications Message Protocol - data link protocol used in Digital Equipment Company's DECNET.

DECNET - Digital Equipment Company's network architecture.

Dedicated Circuit - A permanently established network connection between two or more stations; contrast with switched circuit.

DEMS - Digital Electronic Message Service - nationwide common carrier digital networks which provide high-speed, end-to-end, two-way transmission of digitally-encoded information using the 10.6 GHz band.

DIA - IBM's Document Interchange Architecture - protocols for transfer of documents (text) between different hardware and software systems within IBM's DISOSS.

DISOSS - IBM's DIStributed Office Support System - office automation environment, based on DCA and DIA, which permits document (text) transfer between different hardware and software systems without requiring subsequent format or content revision.

Distributed Data Processing - The development of programmable intelligence in order to perform a data processing function where it can be accomplished most effectively through computers and terminals arranged in a telecommunications network adapted to the user's characteristics.

DTE - Data Terminal Equipment - hardware which is a data source or sink or both, such as video display terminals that convert user information into data for transmission and reconvert data signals into user information.

EBCDIC - Extended Binary Coded Decimal Interchange Code - eight-bit code typically used in IBM mainframe environments.

EFT - Electronic funds transfer.

Encryption - Electrical, code-based conversion of transmitted data to provide security and/or privacy of data between authorized access points.

End User - One who is using a product or service to accomplish his or her own functions. The end user may buy a system from the hardware supplier(s) and do his or her own programming, interfacing, and installation. Alternately, the end user may buy a turnkey system from a systems house or hardware integrator, or may buy a service from an in-house department or external vendor.

Engineering Change Notice (ECN) - Product changes to improve the product after it has been released to production.

Engineering Change Order (ECO) - The follow-up to ECNs - they include parts and a bill of materials to effect the change in the hardware.

Equipment Operators - Individuals operating computer control consoles and/or peripheral equipment (BLS definition).

Ethernet - Local area network developed by Xerox PARC using baseband signaling, CSMA/CD protocol, and coaxial cable to achieve a 10 mbps data rate.

Facsimile - Transmission and reception of data in graphic form, usually fixed images of documents, through scanning and conversion of a picture signal.

FDM - Frequency Division Multiplexing - a multiplexing method that permits multiple access by assigning different frequencies of the available bandwidth to different channels.

FEP - Front-End Processor - communications concentrator such as the IBM 3725 or COMTEN 3690 used to interface communications lines to host computers.

Field Engineer (FE) - Field engineer, customer engineer, serviceperson, and maintenance person are used interchangeably and refer to the individual who responds to a user's service call to repair a device or system.

Full-Duplex - Bi-directional communications with simultaneous two-way transmission.

General Purpose Computer System - A computer designed to handle a wide variety of problems. Includes machine room peripherals, systems software, and small business systems.

Half-Duplex - Bi-directional communications, but only in one direction at a time.

Hardware Integrator - Develops system interface electronics and controllers for the CPU, sensors, peripherals, and all other ancillary hardware components. The hardware integrator also may develop control system software in addition to installing the entire system at the end-user site.

HDLC - High-level Data Link Control.

Hertz - Number of signal oscillations (cycles) per second - abbreviated Hz.

IBM Token Ring - IBM's local area network using baseband signalling and operating at 4 mbps on twisted-pair copper wire. Actually a combination of star and ring topologies – IEEE 802.5-compatible.

IDN - Integrated Digital Network - digital switching and transmission; part of the evolution to ISDN.

Independent Suppliers - Suppliers of machine room peripherals - usually do not supply general purpose computer systems.

Information Processing - Data processing as a whole, including use of business and scientific computers.

Installed Base - Cumulative number or value (cost when new) of computers in use.

Interconnection - Physical linkage between devices on a network.

Interoperability - The capability to operate with other devices on a network. To be contrasted with interconnection, which merely guarantees a physical network interface.

ISDN - Integrated Services Digital Network - integrated voice and non-voice public network service which is completely digital. Not clearly defined through any existing standards although FCC and other federal agencies are participating in the development of CCITT recommendations.

Keypunch Operators - Individuals operating keypunch machines (similar in operation to electric typewriters) to transcribe data from source materials onto punch cards.

Lease Line - Permanent connection between two network stations. Also known as dedicated or non-switched line.

Machine Repairers - Individuals who install and periodically service computer systems.

Machine Room Peripherals - Peripheral equipment that is generally located close to the central processing unit.

Mainframe - The central processing unit (CPU or units in a parallel processor) of a computer that interprets and executes computer (software) instructions of 32 bits or more. Usually refers to traditional mainframes (such as IBM 30XX, UNISYS (Sperry) 1100/XX, Honeywell DDPS88, UNISYS (Burroughs) A15, or CDC (Cyber series).

MAP - Manufacturing Automation Protocol - seven-layer communications standard for factory environments promoted by General Motors/EDS. Adopts IEEE 802.2 and IEEE 802.4 standards plus OSI protocols for other layers of the architecture.

Mean Time to Repair - The mean of elapsed times from the arrival of the field engineer on the user's site until the device is repaired and returned to user service.

Mean Time to Respond - The mean of elapsed times from the user call for services and the arrival of the field engineer on the user's site.

Message - A communication intended to be read by a person. The quality of the received document need not be high, only readable. Graphic materials are not included.

MMFS - Manufacturing Messaging Format Standard - application-level protocol included within MAP.

Modem - A device that encodes information into electronically transmittable from (MOdulator) and restores it to original analog form (DEModulator).

NCP - Network Control Program - software used in IBM 3705/3725 FEPs for control of SNA networks.

Node - Connection point of three or more independent transmission points which may provide switching or data collection.

Off-Line - Pertaining to equipment or devices that can function without direct control of the central processing unit.

On-Line - Pertaining to equipment or devices under direct control of the central processing unit.

OSI - ISO reference model for Open Systems Interconnection - seven-layer architecture for application, presentation, session, transport, network, data link, and physical services and equipment.

OSI Application Layer - Layer 7, providing end-user applications services for data processing.

OSI Data Link Layer - Layer 2, providing transmission protocols, including frame management, link flow control, and link initiation/release.

OSI Network Layer - Layer 3, providing call establishment and clearing control through the network nodes.

OSI Physical Layer - Layer 1, providing the mechanical, electrical, functional, and procedural characteristics to establish, maintain, and release physical connections to the network.

OSI Presentation Layer - Layer 6, providing data formats and information such as data translation, data encoding/decoding, and command translation.

OSI Session Layer - Layer 5, establishes, maintains, and terminates logical connections for the transfer of data between processes.

OSI Transport Layer - Layer 4, providing end-to-end terminal control signals such as acknowledgements.

Overseas - Not within the geographical limits of the continental United States, Alaska, Hawaii, and U.S. possessions.

PABX - Private Automated Branch Exchange - hardware that provides automatic (electro-mechanical or electronic) local circuit switching on a customer's premises.

PAD - Packet Assembler-Disassembler - a device that enables DTE not equipped for packet switching operation to operate on a packet switched network.

PBX - Private Branch Exchange - hardware which provides local circuit switching on the customer premise.

PCM - Pulse-Code Modulation - modulation involving conversion of a waveform from analog to digital form through coding.

PDN - Public Data Network - a network established and operated by a recognized private operating agency, a telecommunications administration, or other agency for the specific purpose of providing data transmission services to the public.

Peripherals - Any unit of input/output equipment in a computer system, exclusive of the central processing unit.

PPM - Pulse Position Modulation.

Private Network - A network established and operated for one user or user organization.

Programmers - Persons mainly involved in designing, writing, and testing of computer software programs.

Protocols - The rules for communication system operation that must be followed if communication is to be effected. Protocols may govern portions of a network or service. In digital networks, protocols are digitally encoded as instructions to computerized equipment.

Public Network - A network established and operated for more than one user with shared access, usually available on a subscription basis. See related international definition of PDN.

Scientific Computer System - A computer system designed to process structured mathematics, such as Fast Fourier Transforms, and complex, highly redundant information, such as seismic data, sonar data, and radar, with large on-line memories and very high capacity throughput.

SDLC - Synchronous Data Link Control - IBM's data link control for SNA. Supports a subset of HDLC modes.

SDN - Software-Defined Network.

Security - Physical, electrical, and computer (digital) coding procedures to protect the contents of computer files and data transmission from inadvertent or unauthorized disclosure to meet the requirements of the Privacy Act and national classified information regulations.

Service Delivery Point - The location of the physical interface between a network and customer/user equipment.

Simplex - Undirectional communications.

Smart Box - A device for adapting existing DTE to new network standards such as OSI. Includes PADs and protocol convertors, for example.

SNA - Systems Network Architecture-seven-layer communications architecture designed by IBM. Layers correspond roughly but not exactly to OSI model.

Software - Computer programs.

Supplies - Includes materials associated with the use or operations of computer systems, such as printer paper, keypunch cards, disk packs, and tapes.

Switched Circuit - Temporary connection between two network stations established through dial-up procedures.

Synchronous - Communications operation with separate, continuous clocking at both sending and receiving stations.

Systems Analyst - Individual who analyzes problems to be converted to a programmable form for application to computer systems.

Systems House - Vendor that acquires, assembles, and integrates hardware and software into a total system to satisfy the data processing requirements of an end user. The vendor also may develop systems software products for license to end users. The systems house vendor does not manufacture mainframes.

Systems Integrator - Systems house vendor that develops systems interface electronics, applications software, and controllers for the CPU, peripherals, and ancillary subsystems that may have been provided by a contractor or the government (GFE). This vendor may either supervise or perform the installation and testing of the completed system.

TI - Bell System designation for 1.544 mbps carrier capable of handling 24 PCM voice channels.

TDM - Time Division Multiplexing - a multiplexing method that interleaves multiple transmissions on a single circuit by assigning a different time slot to each channel.

Token Passing - Local area network protocol which allows a station to transmit only when it has the "token," an empty slot on the carrier.

TOP - Technical Office Protocol - protocol developed by Boeing Computer Services to support administrative and office operations as complementary functions to factory automation implemented under MAP.

Turnkey System - System composed of hardware and software integrated into a total system designed to completely fulfill the processing requirements of a single application.

Twisted-Pair Cable - Communications cabling consisting of pairs of single-strand metallic electrical conductors, such as copper wires, typically used in building telephone wiring and some LANs.

Verification and Validation - Process for examining and testing applications and special systems software to verify that it operates on the target CPU and performs all of the functions specified by the user.

Voice-Grade - Circuit or signal in the 300-3300 Hz bandwidth typical of the public telephone system - nominally a 4 KHz user.

VTAM - Virtual Telecommunications Access Method - host-resident communications software for SNA networks.

E
Other Considerations

When questions arise as to the proper place to count certain user expenditures, INPUT addresses the questions from the user viewpoint. Expenditures then are categorized according to what the users perceive they are buying.

Glossary of Federal Acronyms

Appendix: Glossary of Federal Acronyms

The federal government's procurement language uses a combination of acronyms, phrases, and words that is complicated by different agency definitions and interpretations. The government also uses terms of accounting, business, economics, engineering, and law with new applications and technology.

Acronyms and contract terms that INPUT encountered most often in program documentation and interviews for this report are included here, but this glossary should not be considered all-inclusive. Federal procurement regulations (DAR, FPR, FAR, FIRMR, FPMR) and contract terms listed in RFIs, RFPs, and RFQs provide applicable terms and definitions.

Federal agency acronyms have been included to the extent they are employed in this report.

A

Acronyms

AAS	Automatic Addressing System.
AATMS	Advanced Air Traffic Management System.
ACO	Administrative Contracting Offices (DCAS).
ACS	Advanced Communications Satellite (formerly NASA 30/20 GHz Satellite Program).
ACT-1	Advanced Computer Techniques (Air Force).
Ada	DoD High-Order Language.
ADA	Airborne Data Acquisition.
ADL	Authorized Data List.
ADS	Automatic Digital Switches (DCS).
AFA	Air Force Association.
AFCEA	Armed Forces Communications Electronics Association.
AGE	Aerospace Ground Equipment.
AIP	Array Information Processing.

AIS	Automated Information System
AMPE	Automated Message Processing Equipment.
AMPS	Automated Message Processing System.
AMSL	Acquisition Management Systems List.
ANG	Army National Guard
AP(P)	Advance Procurement Plan.
Appropriation	Congressionally approved funding for authorized programs and activities of the Executive Branch.
APR	Agency Procurement Request.
ARPANET	DARPA network of scientific computers.
ASP	Aggregated Switch Procurement
ATLAS	Abbreviated Test Language for All Systems (for ATE-Automated Test Equipment).
Authorization	In the legislative process programs, staffing, and other routine activities must be approved by Oversight Committees before the Appropriations Committee will approve the money from the budget.
AUSA	Association of the U.S. Army.
AUTODIN	AUTOmatic DIgital Network of the Defense Communications System.
AUTOSEVOCOM	Automatic Secure Voice Communications Network
AUTOVON	AUTOmatic VOice Network of the Defense Communications System.
BA	Basic Agreement.
BAFO	Best And Final Offer.
Base level	Procurement, purchasing, and contracting at the military installation level.
BCA	Board of Contract Appeals.
Benchmark	Method of evaluating ability of a candidate computer system to meet user requirements.
Bid protest	Objection (in writing, before or after contract award) to some aspect of a solicitation by a valid bidder.
BML	Bidders Mailing List - qualified vendor information filed annually with federal agencies to automatically receive RFPs and RFQs in areas of claimed competence.
BOA	Basic Ordering Agreement.
B&P	Bid and Proposal - vendor activities in response to government solicitation/specific overhead allowance.
BPA	Blanked Purchase Agreement.
Budget	Federal Budget, proposed by the President and subject to Congressional review.
C^2	Command and Control.
C^3	Command, Control, and Communications.
C^4	Command, Control, Communications, and Computers.
C^3I	Command, Control, Communications, and Intelligence.
CAB	Contract Adjustment Board or Contract Appeals Board.
CADE	Computer-Aided Design and Engineering.
CADS	Computer-Assisted Display Systems.
CAIS	Computer-Assisted Instruction System.
CALS	Computer-Aided Automated Logistic System
CAPS	Command Automation Procurement Systems.

CAS	Contract Administration Services or Cost Accounting Standards.
CASB	Cost Accounting Standards Board.
CASP	Computer-Assisted Search Planning.
CBD	Commerce Business Daily - U.S. Department of Commerce publication listing government contract opportunities and awards.
CBO	Congressional Budget Office.
CCEP	Commercial Comsec Endorsement Program
CCDR	Contractor Cost Data Reporting.
CCN	Contract Change Notice.
CCPDS	Command Center Processing and Display Systems.
CCPO	Central Civilian Personnel Office.
CCTC	Command and Control Technical Center (JCS).
CDR	Critical Design Review.
CDRL	Contractor Data Requirement List.
CFE	Contractor-Furnished Equipment.
CFR	Code of Federal Regulations.
CICA	Competition in Contracting Act
CIG	Computerized Interactive Graphics.
CIR	Cost Information Reports.
CM	Configuration Management.
CMI	Computer-Managed Instruction.
CNI	Communications, Navigation, and Identification.
CO	Contracting Office, Contract Offices, or Change Order.
COC	Certificate of Competency (administered by the Small Business Administration).
COCO	Contractor-Owned, Contractor-Operated.
CODSIA	Council of Defense and Space Industry Associations.
COMSTAT	Communications Satellite Corporation.
CONUS	CONtinental United States.
COP	Capability Objective Package.
COTR	Contracting Officer's Technical Representative.
CP	Communications Processor.
CPAF	Cost-Plus-Award-Fee Contract.
CPFF	Cost-Plus-Fixed-Fee Contract.
CPIF	Cost-Plus-Incentive-Fee Contract.
CPR	Cost Performance Reports.
CPSR	Contractor Procurement System Review.
CR	Cost Reimbursement (Cost Plus Contract).
CSA	Combat or Computer Systems Architecture.
C/SCSC	Cost/Schedule Control System Criteria (also called "C-Spec").
CWAS	Contractor Weighted Average Share in Cost Risk.
DAL	Data Accession List.
DAR	Defense Acquisition Regulations.
DARPA	Defense Advanced Research Projects Agency.
DAS	Data Acquisition System.
DBHS	Data Base Handling System.
DCA	Defense Communications Agency.

DCAA	Defense Contract Audit Agency.
DCAS	Defense Contract Administration Services.
DCASR	DCAS Region.
DCC	Digital Control Computer.
DCP	Development Concept Paper (DoD).
DCS	Defense Communications System.
DCTN	Defense Commercial Telecommunications Network.
DDA	Dynamic Demand Assessment (Delta Modulation).
DDC	Defense Documentation Center.
DDL	Digital Data Link - A segment of a communications network used for data transmission in digital form.
DDN	Defense Data Network.
DDS	Dynamic Diagnostics System.
DECCO	DEfense Commercial Communications Office
DECEO	DEfense Communications Engineering Office
D&F	Determination and Findings - required documentation for approval of a negotiated procurement.
DIA	Defense Intelligence Agency.
DIF	Document Interchange Format, Navy-sponsored word processing standard.
DHHS	Department of Health and Human Services
DIDS	Defense Integrated Data Systems.
DISC	Defense Industrial Supply Center.
DLA	Defense Logistics Agency.
DMA	Defense Mapping Agency.
DNA	Defense Nuclear Agency.
DO	Delivery Order.
DOA	Department of Agriculture (also USDA).
DOC	Department of Commerce.
DOE	Department of Energy.
DOI	Department of Interior.
DOJ	Department of Justice.
DOS	Department of State.
DOT	Department of Transportation.
DPA	Delegation of Procurement Authority (granted by GSA under FPRs).
DPC	Defense Procurement Circular.
DQ	Definite Quantity Contract.
DQ/PL	Definite Quantity Price List Contract.
DR	Deficiency Report
DSCS	Defense Satellite Communication System
DSN	Defense Switched Network
DSP	Defense Support Program (WWMCCS).
DSS	Defense Supply Service.
DTC	Design-To-Cost.
ECP	Engineering Change Proposal.
ED	Department of Education.
EEO	Equal Employment Opportunity.
8(a) Set-Aside	Agency awards direct to Small Business Administration for direct placement with a socially/economically disadvantaged company.

EMC	Electro-Magnetic Compatibility.
EMCS	Energy Monitoring and Control System.
EO	Executive Order - Order issued by the President.
EOQ	Economic Ordering Quantity.
EPA	Economic Price Adjustment.
EPA	Environmental Protection Agency.
EPMR	Estimated Peak Monthly Requirement.
EPS	Emergency Procurement Service (GSA) or Emergency Power System.
EUC	End User Computing, especially in DoD.
FA	Formal Advertising.
FAC	Facility Contract.
FAR	Federal Acquisition Regulations.
FCA	Functional Configuration Audit.
FCC	Federal Communications Commission.
FCDC	Federal Contract Data Center.
FCRC	Federal Contract Research Center.
FDPC	Federal Data Processing Center.
FEDSIM	Federal (Computer) Simulation Center (GSA).
FEMA	Federal Emergency Management Agency.
FFP	Firm Fixed-Price Contract (also Lump Sum Contract).
FIPS	NBS Federal Information Processing Standard.
FIPS PUBS	FIPS Publications.
FIRMR	Federal Information Resource Management Regulations.
FMS	Foreign Military Sales.
FOC	Final Operating Capability.
FOIA	Freedom of Information Act.
FP	Fixed-Price Contract.
FP-L/H	Fixed-Price - Labor/Hour Contract.
FP-LOE	Fixed-Price - Level-Of-Effort Contract.
FPMR	Federal Property Management Regulations.
FPR	Federal Procurement Regulations.
FSC	Federal Supply Classification.
FSG	Federal Supply Group.
FSN	Federal Supply Number.
FSS	Federal Supply Schedule or Federal Supply Service (GSA).
FSTS	Federal Secure Telecommunications System.
FT Fund	A revolving fund, designated as the Federal Telecommunications Fund, used by GSA to pay for GSA-provided common-user services, specifically including the current FTS and proposed FTS 2000 services.
FTPS	Federal Telecommunications Standards Program administered by NCS; Standards are published by GSA.
FTS	Federal Telecommunications System.
FTS 2000	Proposed replacement for the Federal Telecommunications System.
FY	Fiscal Year.
FYDP	Five-Year Defense Plan.
GAO	General Accounting Office.
GFE	Government-Furnished Equipment.

GFM	Government-Furnished Material.
GFY	Government Fiscal Year (October to September).
GIDEP	Government-Industry Data Exchange Program.
GOCO	Government Owned - Contractor Operated.
GOGO	Government Owned - Government Operated.
GOSIP	Government Open Systems Interconnect Profile
GPO	Government Printing Office.
GPS	Global Positioning System.
GRH	Gramm-Rudman-Hollings Act (1985), also called Gramm-Rudman Deficit Control
GS	General Schedule.
GSA	General Services Administration.
GSBCA	General Services Administration Board of Contract Appeals.
HCFA	Health Care Financing Administration.
HHS	(Department of) Health and Human Services.
HPA	Head of Procuring Activity.
HSDP	High-Speed Data Processors.
HUD	(Department of) Housing and Urban Development.
ICA	Independent Cost Analysis.
ICAM	Integrated Computer-Aided Manufacturing.
ICE	Independent Cost Estimate.
ICP	Inventory Control Point.
ICST	Institute for Computer Sciences and Technology, National Bureau of Standards, Department of Commerce.
IDAMS	Image Display And Manipulation System.
IDEP	Interservice Data Exchange Program.
IDN	Integrated Data Network.
IFB	Invitation For Bids.
IOC	Initial Operating Capability.
IOI	Internal Operating Instructions.
IPS	Integrated Procurement System.
IQ	Indefinite Quantity Contract.
IR&D	Independent Research & Development.
IRM	Information Resource Manager.
IXS	Information Exchange System.
JOCIT	Jovial Compiler Implementation Tool.
JSIPS	Joint Systems Integration Planning Staff.
JSOP	Joint Strategic Objectives Plan.
JSOR	Joint Service Operational Requirement.
JUMPS	Joint Uniform Military Pay System.
LC	Letter Contract.
LCC	Life Cycle Costing.
LCMP	Life Cycle Management Procedures (DD7920.1).

LCMS	Life Cycle Management System.
L-H	Labor-Hour Contract.
LOI	Letter of Interest.
LRPE	Long-Range Procurement Estimate.
LRIRP	Long-Range Information Resource Plan.
MAISRC	Major Automated Information Systems Review Council (DoD).
MANTECH	MANufacturing TECHnology.
MAPS	Multiple Address Processing System.
MAP/TOP	Manufacturing Automation Protocol/Technical and Office Protocol.
MASC	Multiple Award Schedule Contract.
MDA	Multiplexed Data Accumulator.
MENS	Mission Element Need Statement or Mission Essential Need Statement (see DD-5000.1 Major Systems Acquisition).
MILSCAP	Military Standard Contract Administration Procedures.
MIL SPEC	Military Specification.
MIL STD	Military Standard.
MIPR	Military Interdepartmental Purchase Request.
MOD	Modification.
MOL	Maximum Ordering Limit (Federal Supply Service).
MPC	Military Procurement Code.
MYP	Multi-Year Procurement.
NARDIC	Navy Research and Development Information Center.
NASA	National Aeronautics and Space Administration.
NBS	National Bureau of Standards.
NCMA	National Contract Management Association.
NCS	National Communications System; responsible for setting U.S. Government standards administered by GSA; also holds primary responsibility for emergency communications planning.
NICRAD	Navy-Industry Cooperative Research and Development.
NIP	Notice of Intent to Purchase.
NMCS	National Military Command System.
NSA	National Security Agency.
NSEP	National Security and Emergency Preparedness.
NSF	National Science Foundation.
NSIA	National Security Industrial Association.
NTIA	National Telecommunications and Information Administration of the Department of Commerce; replaced the Office of Telecommunications Policy in 1970 as planner and coordinator for government communications programs; primarily responsible for radio.
NTIS	National Technical Information Service.
Obligation	"Earmarking" of specific funding for a contract from committed agency funds.
OCS	Office of Contract Settlement.
OFCC	Office of Federal Contract Compliance.
Off-Site	Services to be provided near but not in government facilities.
OFMP	Office of Federal Management Policy (GSA).

OFPP	Office of Federal Procurement Policy.
OIRM	Office of Information Resources Management.
O&M	Operations & Maintenance.
OMB	Office of Management and Budget.
O,M&R	Operations, Maintenance, and Readiness.
On-Site	Services to be performed on a government installation or in a specified building.
OPM	Office of Procurement Management (GSA) or Office of Personnel Management.
Options	Sole-source additions to the base contract for services or goods to be exercised at the government's discretion.
OSHA	Occupational Safety and Health Act.
OSI	Open System Interconnect
OSP	Offshore Procurement.
OTA	Office of Technology Assessment (Congress).
Out-Year	Proposed funding for fiscal years beyond the Budget Year (next fiscal year).
P-I	FY Defense Production Budget.
P3I	Pre-Planned Product Improvement (program in DoD).
PAR	Procurement Authorization Request or Procurement Action Report.
PAS	Pre-Award Survey.
PASS	Procurement Automated Source System.
PCO	Procurement Contracting Officer.
PDA	Principal Development Agency.
PDM	Program Decision Memorandum.
PDR	Preliminary Design Review.
PIR	Procurement Information Reporting.
PME	Performance Monitoring Equipment.
PMP	Purchase Management Plan.
PO	Purchase Order or Program Office.
POM	Program Objective Memorandum.
POSIX	Portable Open System Interconnect Exchange.
POTS	Purchase of Telephone Systems.
PPBS	Planning, Programming, Budgeting System.
PR	Purchase Request or Procurement Requisition.
PRA	Paperwork Reduction Act.
PS	Performance Specification - alternative to a Statement of Work, when work to be performed can be clearly specified.
QA	Quality Assurance.
QAO	Quality Assurance Office.
QMCS	Quality Monitoring and Control System (DoD software).
QMR	Qualitative Material Requirement (Army).
QPL	Qualified Products List.
QRC	Quick Reaction Capability.
QRI	Quick Reaction Inquiry.
R-I	FY Defense RDT&E Budget.
RAM	Reliability, Availability, and Maintainability.
RC	Requirements Contract.

R&D	Research and Development.
RDA	Research, Development, and Acquisition.
RDD	Required Delivery Date.
RD&E	Research, Development, and Engineering.
RDF	Rapid Deployment Force.
RDT&E	Research, Development, Test, and Engineering.
RFI	Request For Information.
RFP	Request For Proposal.
RFQ	Request For Quotation.
RFTP	Request For Technical Proposals (Two-Step).
ROC	Required Operational Capability.
ROI	Return On Investment.
RTAS	Real Time Analysis System.
RTDS	Real Time Display System.
SA	Supplemental Agreement.
SBA	Small Business Administration.
SB Set-Aside	Small Business Set-Aside contract opportunities with bidders limited to certified small businesses.
SCA	Service Contract Act (1964 as amended).
SCN	Specification Change Notice.
SDN	Secure Data Network.
SEC	Securities and Exchange Commission.
SE&I	Systems Engineering and Integration.
SETA	Systems Engineering/Technical Assistance.
SETS	Systems Engineering/Technical Support.
SIBAC	Simplified Intragovernmental Billing and Collection System.
SIMP	Systems Integration Master Plan.
SIOP	Single Integrated Operations Plan.
SNAP	Shipboard Nontactical ADP Program.
Sole Source	Contract award without competition.
Solicitation	Invitation to submit a bid.
SOR	Specific Operational Requirement.
SOW	Statement of Work.
SSA	Source Selection Authority (DoD).
SSAC	Source Selection Advisory Council.
SSEB	Source Selection Evaluation Board.
SSO	Source Selection Official (NASA).
STINFO	Scientific and Technical INFOrmation Program - Air Force/NASA.
STU	Secure Telephone Unit.
SWO	Stop-Work Order.
Synopsis	Brief Description of contract opportunity in CBD after D&F and before release of solicitation.
TA/AS	Technical Assistance/Analysis Services.
TCP/IP	Transmission Control Protocol/Internet Protocol.

TEMPEST	Studies, inspections, and tests of unintentional electromagnetic radiation from computer, communication, command, and control equipment that may cause unauthorized disclosure of information; usually applied to DoD and security agency testing programs.
TILO	Technical and Industrial Liason Office—Qualified Requirement Information Program - Army.
TM	Time and Materials contract.
TOA	Total Obligational Authority (Defense).
TOD	Technical Objective Document.
TR	Temporary Regulation (added to FPR, FAR).
TRACE	Total Risk Assessing Cost Estimate.
TRCO	Technical Representative of the Contracting Offices.
TREAS	Department of Treasury.
TRP	Technical Resources Plan.
TSP	GSA's Teleprocessing Services Program.
TVA	Tennessee Valley Authority.
UCAS	Uniform Cost Accounting System.
USA	U.S. Army.
USAF	U.S. Air Force.
USCG	U.S. Coast Guard.
USMC	U.S. Marine Corps.
USN	U.S. Navy.
U.S.C.	United States Code.
USPS	United States Postal Service.
USRRB	United States Railroad Retirement Board.
VA	Veterans Administration.
VE	Value Engineering.
VHSIC	Very High Speed Integrated Circuits.
VIABLE	Vertical Installation Automation BaseLine (Army).
VICI	Voice Input Code Identifier.
WBS	Work Breakdown Structure.
WGM	Weighted Guidelines Method.
WIN	WWMCCS Intercomputer Network.
WITS	Washington Interagency Telecommunications System.
WIS	WWMCCS Information Systems.
WS	Work Statement - Offerer's description of the work to be done (proposal or contract).
WWMCCS	World-Wide Military Command and Control System.

B

General and Industry

ADAPSO	Association of Data Processing Service Organization, now the Computer Software and Services Industry Association.
ADP	Automatic Data Processing.
ADPE	Automatic Data Processing Equipment.
ANSI	American National Standards Institute.
BOC	BELL Operating Company.
CAD	Computer-Aided Design.
CAM	Computer-Aided Manufacturing.
CBEMA	Computer and Business Equipment Manufacturers Association.
CCIA	Computers and Communications Industry Association.
CCITT	Comite Consultaif Internationale de Telegraphique et Telephonique; Committee of the International Telecommunication Union.
COBOL	COmmon Business-Oriented Language.
COS	Corporation for Open Systems
CPU	Central Processor Unit.
DMBS	Data Base Management System.
DRAM	Dynamic Random Access Memory
EIA	Electronic Industries Association.
EPROM	Erasible Programmable Read-Only-Memory.
IEEE	Institute of Electrical and Electronics Engineers.
ISDN	Integrated Services Digital Networks.
ISO	International Organization for Standardization; voluntary international standards organization and member of CCITT.
ITU	International Telecommunication Union.
LSI	Large-Scale Integration.
MFJ	Modified Final Judgement.
PROM	Programmable Read-Only Memory.
RBOC	Regional Bell Operating Company.
UNIX	AT&T Proprietary Operating System.
UPS	Uninterruptable Power Source.
VAR	Value Added Retailer.
VLSI	Very Large Scale Integration.
WORM	Write-Once-Read-Many-Times.

Policies, Regulations, and Standards

Appendix: Policies, Regulations, and Standards

A

OMB Circulars

A-11	Preparation and Submission of Budget Estimates.
A-49	Use of Management and Operating Contracts.
A-71	Responsibilities for the Administration and Management of Automatic Data Processing Activities.
A-76	Policies for Acquiring Commercial or Industrial Products and Services Needed by the Government.
A-109	Major Systems Acquisitions.
A-120	Guidelines for the Use of Consulting Services.
A-121	Cost Accounting, Cost Recovery, and Integrated Sharing of Data Processing Facilities.
A-123	Internal Control Systems.
A-127	Financial Management Systems.
A-130	Management of Federal Information Resources.
A-131	Value Engineering

B

GSA Publications

The FIRMR as published by GSA is the primary regulation for use by federal agencies in the management, acquisition, and use of both ADP and telecommunications information resources.

C

DoD Directives

DD-5000.1	Major System Acquisitions.
DD-5000.2	Major System Acquisition Process.
DD-5000.11	DoD Data Elements and Data Codes Standardization Program.
DD-5000.31	Policy and Procedures for the Management and Control of High-Order Languages and Mandate for Use of Ada Language for all DoDMission-Critical Applications.
DD-5000.35	Defense Acquisition Regulatory Systems.

DD-5200.1	DoD Information Security Program.
DD-5200.28	Security Requirements for Automatic Data Processing (ADP) Systems.
DD-5200.28-M	Manual of Techniques and Procedures for Implementing, Deactivating, Testing, and Evaluating Secure Resource Sharing ADP Systems.
DD-7920.1	Life Cycle Management of Automated Information Systems (AIS).
DD-7920.2	Major Automated Information Systems Approval Process.
DD-7935	Automated Data Systems (ADS) Documentation.

D

Standards

ADCCP	Advanced Data Communications Control Procedures; ANSI Standard X3.66 of 1979; also NBS FIPS 71.
CCITT G.711	International PCM Standard.
CCITT T.0	International Standard for Classification of Facsimile Apparatus for Document Transmission Over Telephone-Type Circuits.
DEA-1	Proposed ISO Standard for Data Encryption Based on the NBS DES.
EIA RS-170	Monochrome Video Standard.
EIA RS-170A	Color Video Standard.
EIA RS-464	EIA PBX Standards.
EIA RS-465	Standard for Group III Facsimile.
EIA RS-466	Facsimile Standard; Procedures for Document Transmission in the General Switched Telephone Network.
EIA RS-232-C	EIA DCE to DTE Interface Standard Using a 25-Pin Connector; Similar to CCITT V-24.
EIA RS-449	New EIA Standard DTE to DCE Interface which Replaces RS-232-C.
FED-STD 1000	Proposed Federal Standard for Adoption of the Full OSI Reference Model.
FED-STD 1026	Federal Data Encryption Standard (DES) Adopted in 1983; also FIPS 46.
FED-STD 1041	Equivalent to FIPS 100.
FED-STD 1061	Group II Facsimile Standard (1981).
FED-STD 1062	Federal Standard for Group III Facsimile; Equivalent to EIA RS-465.
FED-STD 1063	Federal Facsimile Standard; Equivalent to EIA RS-466.
FED- STDs 1005, 1005A-1008	Federal Standards for DCE Coding and Modulation.
FIPS 46	NBS Data Encryption Standard (DES).
FIPS 81	DES Modes of Operation.
FIPS 100	NBS Standard for Packet-Switched Networks; Subset of 1980 CCITT X.25.
FIPS 107	NBS Standard for Local Area Networks, Similar to IEEE 802.2 and 802.3.
FIPS 146	Government Open Systems Interconnection (OSI) Profile (GOSIP).
FIPS 151	NIST POSIX (Portable Operating System Interface for UNIX) Standard.
IEEE 802.2	OSI-Compatible IEEE Standard for Data-Link Control in Local Area Networks.
IEEE 802.3	Local Area Network Standard Similar to Ethernet.
IEEE 802.4	OSI-Compatible Standard for Token-Bus Local Area Networks.

IEEE 802.5	Local Area Networks Standard for Token-Ring Networks.
IEEE P1003.1	POSIX Standard, similar to FIPS 151.
MIL-STD-188-114C	Physical interface protocol similar to RS-232 and RS-449.
MIL-STD-1750A	Embedded system microchip architecture specification.
MIL-STD-1777	IP-Internet Protocol.
MIL-STD-1778	TCP - Transmission Control Protocol.
MIL-STD-1780	File Transfer Protocol.
MIL-STD-1781	Simple Mail Transfer Protocol (Electronic Mail).
MIL-STD-1782	TELNET - Virtual Terminal Protocol.
MIL-STD-1815A	Standard for the Ada Programming Language, February 1983.
MIL-STD 2167	Defense System Software Development.
SVID	UNIX System V Interface Definition
X.21	CCITT Standard for Interface between DTE and DCE for Synchronous Operation on Public Data Networks.
X.25	CCITT Standard for Interface between DTE and DCE for Terminals Operating in the Packet Mode on Public Data Networks.
X.75	CCITT Standard for Links that Interface Different Packet Networks.
X.400	ISO Application-Level Standard for the Electronic Transfer of Messages (Electronic Mail).

Related INPUT Reports

Appendix: Related INPUT Reports

A	
Annual Market Analyses	*U.S. Information Services Vertical Markets, 1987.*
	U.S. Information Services Cross-Industry Markets, 1987.
	Procurement Analysis Reports, GFY 1988-1993.
B	
Industry Surveys	*U.S. Information Services Industry, 1987.*
	Eighteenth Annual ADAPSO Survey of the Computer Services Industry, 1984.
	Directory of Leading U.S. Information Services Vendors, 1988.
C	
Market Reports	*Federal Mid-Size Systems Market, 1988-1993.*
	Federal Software Markets, 1987-1992.
	Federal Systems Integration Market, 1987-1992.
	Federal ADP Facilities Management Market, 1987-1992.
	Federal Telecommunications Market, 1988-1993
	Federal Government Processing Services Market, 1988-1993.
	Federal Office Information Systems Market, 1988-1993.
	U.S. Professional Services Market, 1987-1992

Agency Questionnaire—Federal Large-Scale Systems Market

Appendix: Agency Questionnaire—Federal Large-Scale Systems Market

A

Definitions—Large-Scale Systems

For the purposes of this survey, we have defined "large system" and other related services "for ADP" as follows:

- *Large System*—Refers to traditional mainframes (such as IBM 30XX, UNISYS (Sperry) 1100/XX, Honeywell DDPS88, UNISYS (Burroughs) A15, or CDC Cyber series) and supercomputers (such as products from Cray, ETA, Fujitsu, and the new IBM development effort). Does not include such common products as Digital VAX systems, which are classified as mid-size systems.

- *Midsize System*—Includes IBM 93XX systems, all Digital VAX series systems, and such common UNIX-based systems as Altos and Gould. Intelligent workstations (such as those from Apollo and Sun) are also included. Most large shared logic, integrated office systems, such as those from Wang, Hewlett-Packard and Honeywell Bull would also be considered mid-size systems. Does not include microcomputers (standalone, or shared), embedded systems and CAD/CAM systems.

- *Supercomputer*—High-powered processors with numerical processing throughout that is significantly greater than the fastest general purpose computers, with capacities in the 10-50 million floating point operations per second (MFLOPS) range. Newer supercomputers, with burst modes approaching 300 MFLOPS, main storage size up to 10 million words, and on-line storage in the one-to-three gigabyte class, are labeled Class IV to Class VII in agency long-range plans.

- *Small System*—Refers to personal computers and small utility shared logic systems with ten or fewer terminals.

- *Operation and Maintenance*—(Also referred to as O&M) - Contractor (vendor) staffed support of client ADP/Telecommunications equipment

on-site (on government property), in cases where the vendor does not manage the complete facility and the equipment and initial software suite may not have been provided by the vendor.

- *Maintenance (Hardware and/or Software)*—Vendor furnished services provided after installation and acceptance by the user. These services may be part of a warranty or may be separately contracted; services may be provided by resident or on-call personnel of the vendor.

- *Programming and Analysis*—Including system design, contract or custom programming, code conversion, independent verification and validation (also called "IV&V"), benchmarking.

- *Systems Integration*—Services associated with systems design, integration of computing components, installation and government acceptance of ADP/telecommunications systems under projects called SE&I or SETA. Integration services may be provided with related engineering activities (such as SE&I (Systems Engineering and Integration) or SETA (Systems Engineering and Technical Assistance).

- *Turnkey Systems*—Turnkey systems, also known as integrated systems, include systems and applications software packages with hardware as a single entity. Most CAD/CAM systems and many small business systems are integrated systems. This mode does not include specialized hardware systems such as word processors, cash registers, and process control systems.

- *Professional Services*—Professional services include consulting, education and training, programming and analysis, facilities management, and systems integration.

- *Software Products*—Systems and applications packages which are sold to computer users by equipment manufacturers, independent vendors, and others. Also included are fees for work performed by the vendor to implement a package at the user's site.

B

Agency Questionnaire—Federal Large-Scale Systems Market

This questionnaire is directed to the study of the hardware, software, and services which comprise large-scale computer systems in the federal government. The classification of computer hardware includes traditional mainframes and supercomputers. This study excludes microcomputers, minicomputers and mid-sized hardware equipment. It also excludes embedded systems and CAD/CAM systems.

QU: 1 Does your agency currently have installed any mainframe computer system or supercomputer?

____Yes ____No

How many? Mainframes_____ Supercomputers_____

QU: 2 What hardware equipment comprises your computer system? (Identify equipment types; UNISYS, CDC, IBM, IBM-compatible, DEC, etc./models)

_____

_____

QU: 3 How would you describe the "environment" in which your mainframes/supercomputers are used? (Role within department or agency, programs it supports, multiple sites, laboratory use, data centers)

_____

_____

QU: 4 Does your mainframe or supercomputer support your agency mission? If so, how?

_____

_____

_____

QU: 5 How does your mainframe or supercomputer interface with:

a. Mid-Sized Systems _____

b. Small Systems (PC Networks, Small Minis) _____

QU: 6 What types of applications are being run on your mainframe/supercomputer (large system)? For each application, please specify mainframe or supercomputer.

Mainframe	Supercomputer	Application (check all that apply)
____	____	Information Analysis
____	____	Human Resources/Payroll
____	____	Word Processing
____	____	Electronic Mail
____	____	Electronic Publishing
____	____	Graphics
____	____	Logistics and Distribution
____	____	Accounting
____	____	Management Systems
____	____	Scientific/Engineering
____	____	Administrative
____	____	Project Management

QU: 7 Does your agency plan to add new in-house computers in the next five years? (through 1993)

____Yes ____No ____Don't Know

a. What kind of computers/systems will be added?

_____

_____

b. What major applications will be supported by these new computers/systems?

_____

_____

_____

QU: 8 Does your agency plan to expand, upgrade, or replace any of its current computer systems in the next five years with additional mainframes or supercomputers?

____Yes ____No

(If yes): What major applications will be changed with these systems?

_____

_____

QU: 9a What is your average annual expenditure for hardware?

_____

QU: 9b What percent of your hardware budget is directed to large system hardware/mainframes and supercomputers?

_____

QU: 9c Do you anticipate any change in the amount of large system acquisitions you will have in the next two to five years?

____Yes ____No

What is the nature of the change? _____

QU: 10 What role have systems integrators performed in the acquisition of your large computer systems?

_____

_____

QU: 11 How would you rate the following hardware vendor (contractor) characteristics with respect to performance for your agency? (1 = Definitely Not Satisfactory, 2 = Somewhat Satisfactory, 3 = Satisfactory, 4 = Very Satisfactory, 5 = Outstanding Performance)

	Characteristic	Rating
1.	Application Experience	1 2 3 4 5
2.	Integration Experience	1 2 3 4 5
3.	Staff Experience	1 2 3 4 5
4.	Hardware Offered	1 2 3 4 5
5.	Software Offered	1 2 3 4 5
6.	Support Experience	1 2 3 4 5
7.	Existing Federal Contracts	1 2 3 4 5
8.	Agency Experience	1 2 3 4 5
9.	Price	1 2 3 4 5
10.	Delivery Schedule	1 2 3 4 5

QU: 12 What would be the controlling criteria in selection of a hardware contractor? (Rank #1, 2 & 3)

____Contract Type

____Proposed Technical Solution

____Risk Containment Procedures

____Initial Cost

____Life Cycle Cost

____Other _____

____Don't Know

QU: 13 How does your agency plan to accomplish the change and/or addition of computer systems? (Reply Yes or No to each)

____Buy Hardware Only

____Buy Integrated System(s)

____Buy Turnkey System(s)

____Buy Hardware Separately and Use an Integrated Contractor

____Buy Hardware Separately and Do Integration In-House

____Buy Operational Support with the Hardware

____Move the Applications to Outside Sources Such As:

____Other Agency Data Centers

____Remote Computing Service (for instance, Teleprocessing Services Program)

____Contractor-Owned Contractor-Operated Facilities

QU: 14 What type of contract does your agency prefer for hardware acquisitions?

____Cost Plus

____Fixed Price

____Mix

____Other (specify) _____

Why?

_____

_____

QU: 15a Which type of vendor or organization appears more desirable to providing appropriate large-scale systems for your agency?

____Hardware Manufacturers

____Professional Services Firms

____Software Manufacturers

____Systems Integrators

____Aerospace (Divisions)

____Not-For-Profit

____Foreign Manufacturers

Why?

_____

_____

QU: 15b What impact, if any, will foreign manufactured computer systems have on the federal large-scale market?

_____

_____

QU: 16a Based on either your department (agency's) current or past procurements, how would you rate the overall success level of your vendors (hardware, software, professional services vendors, etc.) teaming relationships. Using a 1 to 5 scale; where 5 means extremely successful; and 1 means not successful at all.

(Circle Response) 1 2 3 4 5

QU: 16b How might the teaming relationship(s) have been improved? (i.e. impact of teaming with operational support vendors)

_____

_____

QU: 17 What would you like to see vendors do in the next two to five years to make their products and services more valuable to the federal government?

_____

_____

_____

SOFTWARE:

These next few questions are regarding the software element of your large size computer system.

QU: 18 How will your system interface requirements dictate the software environment that will be procured for your large-size system(s)?

_____

_____

_____

____N/A; Don't Know

QU: 19 Is your agency using or planning to use either commercial or customized Data Base Management Systems (DBMS)?

Commercial_____ Custom_____

For what types of applications? _____

QU: 20a In your opinion, is your agency going to continue to utilize custom application software in its computer operations? (software development)

____Yes ____No Applications _____

QU: 20b For what types of applications is commercial software now available?

_____

_____

QU: 21 Is there any architectures or software specifications that your agency must comply with? (i.e. Army 3-Tier Architecture)

_____

_____

_____

QU: 22 On a scale of 1-5, with 5 being very important and 1 being not important, please rate the following software selection criteria:

Criteria	Rating
Software Features	1 2 3 4 5
Application Functions	1 2 3 4 5
Ease of Implementation	1 2 3 4 5
Product Price	1 2 3 4 5
Federal Experience	1 2 3 4 5
Support Reputation	1 2 3 4 5

UNIX

QU: 23 How would you rate the overall necessity to your department (agency) of employing UNIX for your large-size computer systems operations through FY 1993? Please use a 1-5 scale; where 5 means of extreme necessity, and 1 means of no necessity at all.

(Circle Response) 1 2 3 4 5

QU: 24 What specific types of software will be needed in the future by your agency to run UNIX?

_____

_____

_____

QU: 25 How do you think each of the following government policies, or programs will impact your department's (agency's) large-scale systems acquisitions through FY 1993? (read each item, record response)

FIRMRS

_____

_____

CICA

_____

_____

Trail Boss

_____

_____

Standards

_____

_____

Any other policy initiatives?

_____

_____

Impact?

_____

_____

QU: 26a Are technology changes affecting your department's (agency's) large-sized system requirements through FY 1993?

____Yes ____No ____Don't Know

QU: 26b What technology changes and how are they affecting your department's (agency's) needs?

_____

_____

_____

QU: 28 Could you identify those industry or market factors (non-technical) that would have the greatest impact on your agency's computer systems plans? (including industry mergers, facilities management/maintenance trends, etc.)

_____

_____

_____

QU: 29 What impact, if any, have federal government budget constraints had on your department's (agency's) large-sized systems requirements through FY 1993?

_____

_____

_____

Industry Questionnaire—Federal Large-Scale Systems Market

Appendix: Industry Questionnaire—Federal Large-Scale Systems Market

A

Definitions—Large-Scale Systems

For the purposes of this survey, we have defined "large system" and other related services "for ADP" as follows:

- *Large System*—Refers to traditional mainframes (such as IBM 30XX, UNISYS (Sperry) 1100/XX, Honeywell DDPS88, UNISYS (Burroughs) A15, or CDC Cyber series) and supercomputers (such as products from Cray, ETA, Fujitsu, and the new IBM development effort). Does not include such common products as Digital VAX systems, which are classified as mid-size systems.

- *Midsize System*—Includes IBM 93XX systems, all Digital VAX series systems, and such common UNIX-based systems as Altos and Gould. Intelligent workstations (such as those from Apollo and Sun) are also included. Most large shared logic, integrated office systems, such as those from Wang, Hewlett-Packard and Honeywell Bull would also be considered mid-size systems. Does not include microcomputers (standalone, or shared), embedded systems and CAD/CAM systems.

- *Supercomputer*—High-powered processors with numerical processing throughout that is significantly greater than the fastest general purpose computers, with capacities in the 10-50 million floating point operations per second (MFLOPS) range. Newer supercomputers, with burst modes approaching 300 MFLOPS, main storage size up to 10 million words, and on-line storage in the one-to-three gigabyte class, are labeled Class IV to Class VII in agency long-range plans.

- *Small System*—Refers to personal computers and small utility shared logic systems with ten or fewer terminals.

- *Operation and Maintenance*—(Also referred to as O&M) - Contractor (vendor) staffed support of client ADP/Telecommunications equipment

on-site (on government property), in cases where the vendor does not manage the complete facility and the equipment and initial software suite may not have been provided by the vendor.

- *Maintenance (Hardware and/or Software)*—Vendor furnished services provided after installation and acceptance by the user. These services may be part of a warranty or may be separately contracted; services may be provided by resident or on-call personnel of the vendor.

- *Programming and Analysis*—Including system design, contract or custom programming, code conversion, independent verification and validation (also called "IV&V"), benchmarking.

- *Systems Integration*—Services associated with systems design, integration of computing components, installation and government acceptance of ADP/telecommunications systems under projects called SE&I or SETA. Integration services may be provided with related engineering activities (such as SE&I (Systems Engineering and Integration) or SETA (Systems Engineering and Technical Assistance).

- *Turnkey Systems*—Turnkey systems, also known as integrated systems, include systems and applications software packages with hardware as a single entity. Most CAD/CAM systems and many small business systems are integrated systems. This mode does not include specialized hardware systems such as word processors, cash registers, and process control systems.

- *Professional Services*—Professional services include consulting, education and training, programming and analysis, facilities management, and systems integration.

- *Software Products*—Systems and applications packages which are sold to computer users by equipment manufacturers, independent vendors, and others. Also included are fees for work performed by the vendor to implement a package at the user's site.

B

Industry Questionnaire—Federal Large-Scale Systems Market

This questionnaire is directed to the study of the hardware, software, and services which comprise large-scale computer systems in the federal government. The classification of computer hardware includes traditional mainframes and the full size supercomputers. This study excludes microcomputers, minicomputers and mid-sized hardware equipment. It also excludes embedded systems and CAD/CAM systems.

Does your company now provide or plan to provide mainframe computers and/or supercomputers to the federal government?

____Yes ____No

(If No, close interview.)

QU: 1 What types of hardware or services do you provide or plan to provide?

	Current		Future	
	Yes	**No**	**Yes**	**No**
Mainframe Computers	____	____	____	____
Supercomputers	____	____	____	____
Other Computer Hardware	____	____	____	____
Hardware Maintenance	____	____	____	____
Software Maintenance	____	____	____	____
Consulting	____	____	____	____
Systems Integration	____	____	____	____
Facilities Management/ Operational Support	____	____	____	____
Programming and Analysis	____	____	____	____
Other (specify)	____	____	____	____

_____

QU: 2 In your opinion, which federal agencies present the best marketing opportunities for the equipment and services your company provides?

DoD Including: _____

Civil Agencies Including: _____

QU: 3 What estimated percent of your hardware revenue is derived from business with the federal government?

_____

QU: 4 What types of applications are being run by the federal agencies on your mainframe/supercomputer (large system)? For each application, please specify mainframe or supercomputer.

Mainframe	Supercomputer	Application (check all that apply)
____	____	Information Analysis
____	____	Human Resources/Payroll
____	____	Word Processing
____	____	Electronic Mail
____	____	Electronic Publishing
____	____	Graphics
____	____	Logistics and Distribution
____	____	Accounting
____	____	Management Systems
____	____	Scientific/Engineering
____	____	Administrative
____	____	Project Management
____	____	Other (specify)

_____

QU: 5a Are you providing operational support in connection with your federal sales?

____Yes ____No

QU: 5b If so, in roughly what percentage of your contracts? _____%

QU: 6 What functions have you performed as a systems integrator in the development of a federal agencies large-scale computer system?

_____

_____

_____

No Response/Not Applicable _____

QU: 7 Do you anticipate any change in the amount of large system acquisitions by federal agencies over the next two to five years?

____Yes ____No

What is the nature of the change? _____

Which hardware areas will be increased/decreased?

_____

QU: 8 In your opinion, do you perceive any increased competition in the federal hardware and related services market arising from the following type vendors or organizations?

Colleges/University Centers _____

Not-for-Profit Organizations _____

Foreign Companies _____
(In conjunction with systems integrators)

New Start-Up Vendors _____

Comments regarding effect on industry:

_____

_____

QU: 9a Based on either your company's current or past contract experience, how would you rate the overall success level of your teaming relationship with other hardware, software professional services vendors, etc.
Using a 1-5 scale; where 5 means extremely successful; and 1 means not successful at all.

(Circle Response) 1 2 3 4 5

No response/no teaming experience _____

QU: 9b How might the teaming relationship(s) have been improved? i.e., impact of teaming with other type vendors (FM, O&M, etc.)

_____

_____

QU: 10 In your opinion, what would you like to see vendors do in the next two to five years to make their products and services more valuable to the federal government?

_____

_____

QU: 11 How would you rate the following hardware vendor (contractor) characteristics with respect to how an agency would rate general industry vendor performance? (1 = Definitely Not Satisfactory, 2 = Somewhat Satisfactory, 3 = Satisfactory, 4 = Very Satisfactory, 5 = Outstanding Performance)

Characteristic	Rating
1. Application Experience	1 2 3 4 5
2. Integration Experience	1 2 3 4 5
3. Staff Experience	1 2 3 4 5
4. Hardware Offered	1 2 3 4 5
5. Software Offered	1 2 3 4 5
6. Support Experience	1 2 3 4 5
7. Existing Federal Contracts	1 2 3 4 5
8. Agency Experience	1 2 3 4 5

9. Price 1 2 3 4 5

10. Delivery Schedule 1 2 3 4 5

QU: 12 In your opinion, what do the federal agencies hold as the controlling criteria in the selection of a hardware contractor? (Rank #1, 2 & 3)

____Contract Type

____Proposed Technical Solution

____Risk Containment Procedures

____Initial Cost

____Life Cycle Cost

____Other _____

____Don't Know

QU: 13 What type of contract is preferred most by federal agencies for large hardware systems acquisitions?

____Cost Plus

____Fixed Price

____Mix

____Other (specify) _____

Why? _____

QU: 14 What type of interfaces do you provide to agencies so that their mainframe and/or supercomputer can interface with:

a. Mid-Sized Computer Systems _____

_____

b. Small Systems (PC Networks, Small Minis) _____

_____

QU: 15 How will your systems interface requirements dictate the software environment that will be procured for the agency's large-sized system(s)?

_____

_____

____N/A; Don't Know

QU: 16 On a scale of 1-5, with 5 being very important and 1 being not important, please rate the following software selection criteria:

Criteria	Rating
Software Features	1 2 3 4 5
Application Functions	1 2 3 4 5
Ease of Implementation	1 2 3 4 5
Product Price	1 2 3 4 5
Federal Experience	1 2 3 4 5
Support Reputation	1 2 3 4 5

No Response/Not Applicable _____

QU: 17 Is there any architectures, standards, or software specifications that your company must comply with in providing software and hardware to the agencies? (i.e. Army 3-Tier Architecture)

_____

_____

_____

QU: 18 How would you rate the overall necessity to your company of employing UNIX-based products for your large-size computer systems through FY 1993? Please use a 1-5 scale; where 5 means of extreme necessity, and 1 means of no necessity at all.

(Circle Response) 1 2 3 4 5

QU: 19 How do you think each of the following government policies, or programs will impact the federal agencies large-scale systems acquisitions through FY 1993?

FIRMRS

CICA

Trail Boss

Gramm-Rudman/Budget Constraints

Any other policy initiatives?

Impact?

QU: 20 What "new" technologies do you think will affect major federal information hardware systems and services procurements in the next five years?

QU: 21 What industry trends will affect the federal market for large computer systems? (mainframes and supercomputers)

_____

_____

_____

Why? _____

About INPUT

Company Profile

INPUT provides planning information, analysis, and recommendations to managers and executives in the information processing industries. Through market research, technology forecasting, and competitive analysis, INPUT supports client management in making informed decisions.

Continuous-information advisory services, proprietary research/consulting, merger/acquisition assistance, and multiclient studies are provided to users and vendors of information systems and sevices (software, processing services, turnkey systems, systems integration, professional services, communications, and systems/software maintenance and support).

Many of INPUT's professional staff members have more than 20 years' experience in their areas of specialization. Most have held senior management positions in operations, marketing, or planning. This expertise enables INPUT to supply practical solutions to complex business problems.

Staff Credentials

Formed as a privately held corporation in 1974, INPUT has become a leading international research and consulting firm. Clients include more than 100 of the world's largest and most technically advanced companies.

INPUT's professional staff have backgrounds in marketing, planning, information processing, and market research in some of the world's leading organizations. Many of INPUT's professional staff have held executive positions in the following business sectors:

- Computer systems
- Software
- Turnkey systems
- Field service (customer service)
- Processing services
- Professional services
- Data processing
- Network services
- Communications

Educational backgrounds include both technical and business specializations, and many INPUT staff hold advanced degrees.

Domestic and European Advisory Services

INPUT offers ten basic information services: eight covering U.S. information industry markets and two covering European information industry markets.

1. Market Analysis Program—U.S. (MAP)

Provides up-to-date U.S. information services market analyses, five-year forecasts, trend analyses, and sound recommendations for action. MAPS is designed to satisfy the planning and marketing requirements of current and potential information services vendors.

2. Market Analysis Program—Europe (MAPE)

Analyzes and forecasts European software and services markets. Clients receive timely planning information through research-based studies, conferences, client meetings, and continuous client support.

3. Vendor Analysis Program (VAP)

Is a comprehensive reference service covering more than 4,000 U.S. information services vendor organizations. VAP is often used for competitive analysis and prescreening of acquisition and joint venture candidates.

4. Electronic Data Interchange Program (EDIP)

Focusing on what is fast becoming a major computer/communications market opportunity, INPUT's EDIP keeps you informed. Through monthly newsletters, timely news flashes, comprehensive studies, a joint user/vendor conference, and telephone inquiry privileges, you will be informed and stay informed about the events and issues impacting this burgeoning market.

5. Systems Integration Program (SIP)

Focus is on the fast-moving world of systems integration, and the provision of complex information systems requiring multiple products and services. Covers this infant segment in-depth by tracking both the federal and commercial markets via monthly project profiles, market analysis reports, a monthly newsletter, seminars, conferences, a presentation, and hotline inquiry service privileges.

6. Federal Information Systems and Services Program (FISSP)

Presents highly specific information on U.S. federal government procurement practices, identifies information services vendor opportunities, and provides guidance from INPUT's experienced Washington professionals to help clients maximize sales effectiveness in the federal government marketplace.

7. Information Systems Program (ISP)

Is designed for executives of small, medium, and large information systems organizations and provides crucial information for planning, procurement, and management decision making. The program examines new service offerings, technological advances, user requirements for systems and services, IS spending patterns, and more. ISP is widely used by both user and vendor organizations.

8. Integrated Communications Program (ICP)

Provides management insight to ensure effective use of telecommunications. This program provides a comprehensive set of services, including major vendor profiles, market/service trends assessment, service quality assessment, national service profiles for 40 countries, quarterly service news reports, a handbook of international public data networks, issue study reports, conferences, and hotline client inquiry services.

9. Customer Service Program—U.S. (CSP)

Provides customer service organization management with data and analyses needed for marketing, technical, financial, and organizational planning. The program pinpoints user perceptions of service received, presents vendor-by-vendor service comparisons, and analyzes and forecasts service markets for large systems, small systems, telecommunications systems, software maintenance, and third-party maintenance.

10. Customer Service Program—Europe (CSPE)

Parallels the U.S. Customer Service Program, dealing with comparable issues in European markets.

Merger & Acquisition Services

INPUT also offers merger and acquisition services that are tailor-made for your requirements. Our years of experience and data base of company information about information systems and services companies have helped many companies.

Customized Advisory Services Available

In addition to standard continuous-information programs, INPUT will work with you to develop and provide a customized advisory service that meets your unique requirements.

An Effective Combination

INPUT'S Executive Advisory Services are built on an effective combination of research-based studies, client meetings, informative conferences, and continuous client support. Each service is designed to deliver the information you need in the form most useful to you, the client. Executive Advisory Services are composed of *varied combinations of the following* products and services:

Research-Based Studies
Following a proven research methodology, INPUT conducts major research studies throughout each program year. Each year INPUT selects issues of concern to management. Topical reports are prepared and delivered throughout the calendar year. 1988 projects include:

- √ SAA - Impact on the Industry
- √ CASE - A Comprehensive Analysis
- √ SI Impact on Professional Services Market
- √ Emerging Network-Based Information Service Markets
- √ VAR - Alternate Distribution Channels
- √ SI Buyer Issues and Trends Report
- √ SI Competitive Analysis Report
- √ SI Forecast and Trends Report
- √ Data Base Management: Current Trends and Challenges
- √ Workstation Strategies Report Series
- √ ISDN andVoice/Data Integration
- √ CASE and Application Development Productivity
- √ EDI and Professional Services
- √ X.400 Products and Services

. . . and more!

Information Service Industry Reports
INPUT's Executive Advisory Services address specific issues, competitive environment, and user expenditures relative to:

Software	Professional Services
Processing/Network Services	Turnkey Systems
Systems Integration	Small-Systems Service
Telecommunications Service	Third-Party Maintenance
Office Systems	Large-Systems Service

Industry Market Reports
Detailed analyses of market trends, forces driving the markets, problems, opportunities, and user expenditures are available for the following segments:

Banking/Finance
Discrete Manufacturing
Distribution
Education
Federal/State and Local Government
Insurance
Medical
Process Manufacturing
Service Industry
Telecommunications
Utilities
Accounting
Education/Training
Engineering/Scientific
Human Resources
Other Cross-Industry Markets
Transportation

Hotline: Client Inquiry Services
Daily, weekly, monthly, quarterly, and annual client planning questions are answered quickly and completely through use of INPUT's Client Hotline. Clients may call any INPUT office (California, New Jersey, Washington D.C., or London) during business hours or they may call a unique voicemail service to place questions after-hours. This effective Hotline service is the cornerstone of every INPUT Executive Advisory Service.

The Information Center
One of the largest and most complete collections of information services industry data, the Information Center houses literally thousands of up-to-date files on vendors, industry markets, applications, current/emerging technologies, and more. Clients have complete access to the Information Center. In addition to the information contained in its files, the center maintains an 18-month inventory of over 130 major trade publications, vendor consultant manuals, economic data, government publications, and a variety of important industry documents.

Access to INPUT Professional Staff
Direct access to our staff, many of whom have more than 20 years of experience in the information industry, provides you continuous research and planning support. When you buy INPUT, you buy experience and knowledge.

Annual Client Conference
Each year, you can attend INPUT's Annual Client Conference. This three-day event addresses the status and future of the information services industry, the competitive environment, important industry trends potentially affecting your business, the impact of new technology and new service offerings, and more.

You will attend with top executives from many of the industry's leading, fastest-growing, and most successful vendor companies, and with top In-

formation Systems (IS) managers from some of the world's most sophisticated user organizations.

On-Site Presentation by INPUT Executive
Many of INPUT's Planning Services offer an informative presentation at your site. Covering the year's research, this session is held in the fourth quarter of each calendar year.

Proprietary Research Service

INPUT conducts proprietary research that meets the unique requirements of an individual client. INPUT's custom research is effectively used:

For Business Planning
Planning for new products, planning for business startups, planning expansion of an existing business or product line—each plan requires reliable information and analysis to support major decisions. INPUT's dedicated efforts and custom research expertise in business planning ensure comprehensive identification and analysis of the many factors affecting the final decision.

For Acquisition Planning
Successful acquisition and divestiture of information services companies requires reliable information. Through constant contact with information services vendor organizations, continuous tracking of company size, growth, financials, and management "chemistry," INPUT can provide the valuable insight and analysis you need to select the most suitable candidates.

For the Total Acquisition Process
INPUT has the credentials, the data base of company information, and most importantly, the contacts to assist you with the total acquisition and/or partnering relationship processes:

- √ Due Diligence
- √ Schedules and Introduction
- √ Criteria & Definitions
- √ Retainer and Fee-Based
- √ Active Search

For Competitive Analysis
Knowing marketing and sales tactics, product capabilities, strategic objectives, competitive posture, and strengths and weaknesses of your competition is as critical as knowing your own. The career experience of INPUT's professionals, coupled with its collection and maintenance of current financial, strategic, tactical, and operational information about more than 4,000 active companies, uniquely qualifies INPUT to provide the best competitive information available today.

For Market and Product Analysis
Developing new products and entering new markets involves considerable investment and risk. INPUT regularly conducts research for clients to identify product requirements, market dynamics, and market growth.

More About INPUT...

- More than 5,000 organizations, worldwide, have charted business directions based on INPUT's research and analysis.
- Many clients invest more than $50,000 each year to receive INPUT's recommendations and planning information.
- INPUT regularly conducts proprietary research for some of the largest companies in the world.
- INPUT has developed and maintains one of the most complete information industry libraries in the world (access is granted to all INPUT clients).
- INPUT clients control an estimated 70% of the total information industry market.
- INPUT analyses and forecasts are founded upon years of practical experience, knowledge of historical industry performance, continual tracking of day-to-day industry events, knowledge of user and vendor plans, and business savvy.
- INPUT analysts accurately predicted the growth of the information services market—at a time when most research organizations deemed it a transient market. INPUT predicted the growth of the microcomputer market in 1980 and accurately forecasted its slowdown in 1984.

For More Information . . .
INPUT offers products and services that can improve productivity, and ultimately profit, in your firm. Please give us a call today. Our representatives will be happy to send you further information on our services or to arrange a formal presentation at your offices.

For details on delivery schedules, client service entitlement, or Hotline support, simply call your nearest INPUT office. Our customer support group will be available to answer your questions.

√	**California**	(415) 961-3300
√	**New Jersey**	(201) 299-6999
√	**Washington, D.C.**	(703) 847-6870
√	**London**	(01) 493-9335
√	**Paris**	(16) 44-80-48-43